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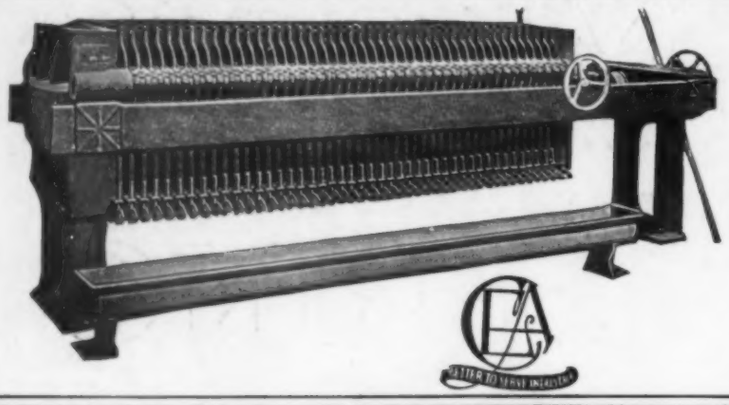

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CHEMICAL & METALLURGICAL ENGINEERING

A consolidation of

ELECTROCHEMICAL & METALLURGICAL INDUSTRY *and* IRON & STEEL MAGAZINE

H. C. PARMELEE, Editor

Volume 30 | New York, January 7, 1924 | Number 1

Chemical & Metallurgical Engineering

is the successor to *Metallurgical & Chemical Engineering*, which, in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine* effected in July, 1906.

The magazine was originally founded as *Electrochemical Industry*, in September, 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January, 1905, when it was changed to *Electrochemical & Metallurgical Industry*. In July, 1906, the consolidation was made with *Iron & Steel Magazine*, that had been founded 8 years previously by Dr. Albert Sauveur. In January, 1910, the title was changed to *Metallurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1, 1915. On July 1, 1918, the title was changed to *Chemical & Metallurgical Engineering*, and weekly publication was begun Oct. 1, 1919.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death on Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee.

The staff of *Chemical & Metallurgical Engineering* comprises: H. C. Parmelee, editor; A. W. Allen, Henry M. Batters, Charles N. Hulburt, Sidney D. Kirkpatrick, R. S. McBride, Graham L. Montgomery, Charles Wadsworth, 3rd, Hans H. Wanders and Alan G. Wikoff, assistant editors; Clifford B. Bellis and Harold J. Payne, editorial assistants.

Business Will Be Good in 1924 if—

AS USUAL with the opening of the new year we find ourselves in the midst of the economic inventory—the annual process of taking stock, the surveying of the past, present and future of industry and trade. This year the problem has been complicated by the uncertainties that business has faced during the greater part of 1923. There is an absence of a definite trend that might help to indicate the direction of future progress. It is a fortunate commentary on the present situation, however, that at a time when grave economic questions are awaiting settlement at the hands of politics, there are in Washington those to whom we can turn for comfort and counsel. The reassuring statements of Secretaries Mellon and Hoover regarding economic prospects of 1924 carry conviction with them. Not in a long time has industry been given such a clear insight into business conditions at home and abroad.

"In looking forward to 1924," Mr. Mellon writes, "it appears that the factors which have been most influential in the revival that has taken place in business during the past year are likely to remain effective, at least in a considerable degree." These factors that determine the economic outlook for our own country are distinctly favorable. The volume of manufacture has reached record levels. The railroads are carrying the greatest traffic in their history. Employment is complete and wages and prices, while relatively high, are gradually stabilizing. Small inventories have become the order of the day and the speculation that leads so easily to inflation is now conspicuously absent. Ample credit is available and for the most part at reasonable rates. And in spite of the political menace of the bonus and other radical legislation, there is the great swing of public opinion that clearly presages the enactment of the Mellon plan for tax reduction.

With such a foundation there can be no question as to the direction of progress during the year. Yet, fortunately, a past experience that is only too vivid in our memories has taught us the folly of proceeding foolhardily by the course of booms and slumps. Much better is the steady progress on the even keel.

The factors from abroad are seen in a new light by means of the "economic weather chart of the world" which Secretary Hoover has ingeniously constructed for us. In it are three distinct areas. The first includes the Western Hemisphere, Asia, Australia and Africa, in all of which there has been distinct economic progress and recovery. The second area is composed of Russia, the Baltic, the Balkan States, the Near East, Italy and Spain, which are characterized as "still struggling with after-war political, social, currency, debt and budget problems, but yet showing undoubted progress in the restoration of commerce and industry." It is in the third area that the storm brews. The economic depression brought about by the Ruhr occupation and German collapse is spreading its baneful influence over all of the rest of Europe. In France the failure to obtain reparations has resulted in an unbalanced budget and an unstable currency. In Great Britain and the other countries the influence is seen in the depressing increase in unemployment. And to Mr. Hoover's thinking: "The economic world has not yet felt the full impact of the occupation of the Ruhr!"

It is true that there is the basis for some encouragement in the present Franco-German negotiations for the settlement of reparations. But one of the essentials

of any program must be a drastic reduction in armament in Europe. If in this country we were to maintain comparable armies, it would mean that 3,000,000 men would be under arms at the present time, which would be a tremendous drain on the economic strength of even so rich a nation as our own.

These are factors that affect us as a nation, politically, socially and industrially. And since they affect industry as a whole they find their clearest reflection in the basic industries served by *Chem. & Met.* The extremely diversified business interests of these industries cannot be reduced to the same common denominator as their technology, but all of them depend directly or indirectly on general industrial conditions. They supply the basic raw materials for consumable goods, the machinery and equipment that make production possible. Business in these industries will be good if we are willing to make it so. If we proceed with caution, prudently applying the methods learned during the lean years of depression, there is every reason why the future can be faced with confidence. Good business will follow where good judgment prevails.

American Chemical Engineering Penetrates Chilean Nitrate Industry

RECOGNIZING the dependence of the United States on Chile for nitrate, an important commodity in the fertilizer and explosives industries, Secretary Hoover obtained from the last Congress an appropriation of $500,000 to survey the world's resources of this and other imported raw materials. As part of the nitrogen survey the Chilean deposits were visited last fall by H. Foster Bain, director of the Bureau of Mines. Part of his report, dealing with the technology of recovering sodium nitrate from caliche, is printed elsewhere in this issue.

General conditions in the nitrate industry are very clearly portrayed by Mr. Bain, particularly so in view of the fact that he was making his first visit to the country and had only a limited time in which to survey an industry of tremendous proportions. One gets a mental view of a large chemical engineering industry moving along in leisurely fashion with wholly inadequate technical direction and control, expanding or contracting to meet the dictates of the banker and financier. The logical consequences of waste and inefficiency are appalling to the engineer who is familiar with the results obtained in other industries—notably the leaching of low-grade gold and copper ores—in all of which the same fundamental extraction processes of chemical engineering have proved applicable. An industry of huge proportions in which recovery of the principal product averages but 65 per cent is indeed an inviting field for research and development. The average loss of 35 per cent is ample evidence of the inefficiency of present empirical methods and the need of science and engineering. But tougher nuts have been cracked by persistent and intelligent effort.

Such effort has not been lacking of late, as Mr. Bain points out in his report. Two processes in particular receive attention, the Allen, which is in operation at Oficina Delaware, and the Guggenheim, under experimentation at Oficina Cecilia. It is perhaps inevitable that here the report enters on controversial ground in attempting to weigh the respective merits of the two processes and their probable future contribution to economic and efficient nitrate production. If we find ourselves not wholly in accord with the conclusions reached, it is with a full realization of the obstacles in the way of getting the facts; and our comment is offered not so much in criticism of the author of the report as in the interest of giving credit where it is due and balancing the impressions that will be gathered from the report by the casual and uninformed reader.

The report rightly states that the Allen process represents "the greatest improvement reduced to practice in nitrate recovery in years," but it dismisses the topic with too brief mention in favor of more extended reference to the experimental and secret Guggenheim process and the professional standing and attainments of Guggenheim engineers.

Allen was undoubtedly the pioneer in introducing into the nitrate industry the bulk-leaching methods of early cyanide practice. Drawing on his experience in the metallurgy of gold and silver, he advocated the finer grinding of caliche, with the inevitable release of more rather than less slime in the leaching charge, in opposition to established local custom. He introduced the filter-bottom tank in order to give adequate support to the material under treatment and used upward percolation, displacing heavier solutions with others of lighter specific gravity. If the Guggenheims intend to apply to the treatment of caliche the copper ore-leaching treatment developed at Chuquicamata, they will follow in the footsteps of Allen, who brought to the nitrate industry the bulk-leaching methods of cyanide practice. Furthermore, Allen's process was successful in its first commercial application in handling the most refractory caliche in the whole field, one that produced a large amount of slime with which the Shanks process had been wholly unable to cope. This characteristic should be emphasized because it has been demonstrated in practical operation. If the Allen process admittedly handles the most difficult material in the field, the point should be made clear, particularly since the report attributes to the Guggenheim process "the largest promise now in sight for making a satisfactory recovery from caliche of widely varying characteristics and in particular from the borriente or slime-making varieties that are so troublesome." Where the Guggenheim process is a hope or expectation, Allen's is a practical achievement adapted to the poorest as well as the best caliche in the country.

It is doubtful if the Guggenheim process "is more radical in its conception" than was Allen's except in its proposed application on a huge scale with new equipment. Fair comparisons cannot be made, because, while the Allen process is an open book, that of the Guggenheims is a secret "for business reasons." Inquiries lead us to believe, however, that practical recoveries by the Allen process have been as high as or higher than the 90 per cent expected in the Guggenheim process. As for cheapening nitrate production, there are those who hold it an open question whether this can best be accomplished through the application of the Allen process to existing equipment, increasing if desirable the size of the leaching units, or by the use of the Guggenheim process in new plants costing $4 per ton of annual capacity, or $4,000,000 for a plant treating a minimum of 1,000,000 tons per year.

Controversy aside, there is in the situation a happy augury that chemical engineering may soon have its day in nitrate recovery. How sadly it has been neglected and how little the chemical engineering nature of the problem has been realized may readily be gained from

Mr. Bain's report. The chemical engineer has been conspicuously absent from the nitrate oficina, and such engineering as has been employed has been directed, curiously enough, toward cheaper power production, despite the fact that power is a minor factor in treating caliche and that no saving in that item could possibly compare with a reduction in nitrate losses and wastage of heat. Too great emphasis cannot be placed on the point that no efficient process can be applied to the treatment of caliche without the aid of constructional and chemical engineers of ability and broad experience, unhampered by the prejudice that has been shown in Chile against specialists in other branches of chemical technology.

Higher recovery of nitrate from caliche has long been recognized as one of the factors that will enable Chile to maintain the world monopoly of nitrate for many years to come. No stretch of the imagination is required to visualize what an additional 25 per cent will mean in this connection. Either the tonnage of caliche of the grade now mined can be greatly reduced or lower grades can be treated profitably and the day of exhaustion of the deposits postponed a generation. It will be striking evidence of the futility of scientific progress if the United States cannot enjoy cheaper nitrate as the result of these improvements. Advances in technology must ultimately prove a powerful economic influence in vastly increasing the production of nitrate and lowering its cost to the nations of the world. Increased consumption, in turn, will be reflected in more abundant agricultural crops and a consequent decrease in the cost of living. In the realization of these benefits American capital and chemical engineering have an exceptional opportunity to play a large and important part.

The Passing of The Forecaster

IN THE SEA of opinion let loose last week in the form of annual reviews and New Year predictions, there was one conspicuous absence. The views of the professional "forecaster" were not among those of the industrial leaders that occupied the front pages of our newspapers. To look for the reason we need go no further than his rather discrediting performance of a year ago.

Unfortunately in the light of experience we have had to revise last year's unanimously optimistic forecast for continued revival and progressive improvement during 1923. To be sure, January, February and March did seem to confirm even the most enthusiastic prediction. This was more or less true in April, with its seasonal splurge in activity that sharply increased wages and costs and started a wave of speculation threatening to carry us into another period of inflation. In May, however, something happened. Without the bubble bursting, without any financial crisis, a great lull set in; business became uncertain and has remained more or less so ever since. Such a course was not on the chart of the forecasters, nor was it in keeping with the extrapolated curves of certain ardent, but poorly grounded, proponents of the theory of the business cycle.

These same proponents, with their misguided enthusiasm, undoubtedly did incalculable harm to good business. Their foolhardiness tended not only to discredit the theory but actually questioned the use and value of statistics in the conduct of business. The old parable of the sower aptly fits the situation. The seed of the cyclic theory fell on shallow ground, the grain grew and waxed beautiful in the sunshine and gentle showers of spring, only to fall with the first blast of the storm. Now it seems that many of those who were too easily converted to the business cycle theory have fallen by the wayside and are attempting to drag the whole statistical structure with them. Rather, their experience should be a lesson to emphasize even more strongly the need for closer study of statistics as a basis for business judgment. Without their use during the past year, business would have been helpless and the recent lull in industrial activity might easily have assumed the proportions of a crisis and panic.

Superiority of American Duralumin

WHILE we have been fully aware of the research that has been carried out for the past few years by American manufacturers of aluminum alloys, the greater experience of Germany in this field of metallurgy and the Germans' reputation for painstaking accuracy and carefulness have probably been responsible for the prevailing idea that no aluminum alloys had yet been made quite equal to the German. The impression has been dispelled, however, by a recent incident from which we learn that the German product has been far outstripped by the American, particularly with respect to that most important single factor—uniformity. In recent conversation with a friend of ours, Commander Weyerbacher, builder of the navy dirigible "Shenandoah," said unofficially that American duralumin is uniformly dependable, while that produced in Germany is sometimes excellent and sometimes "not so good." The elimination of doubt regarding the quality of a material of construction needs no comment; its importance cannot be exaggerated. Incidentally Commander Weyerbacher's statement is a tribute not only to American duralumin but to the practical value of industrial research expressed in terms that should be comprehended even by those manufacturers who are not strong believers in "money for research."

Distillation Fundamentals

IN COMMON with the group of industries now recognized as being based upon chemical engineering, many of the unit processes of chemical engineering originated long ago and developed as empirical arts, practice far outdistancing theory. In the case of fractional distillation, for example, it is only within recent years that theories have developed to a point where they have become useful to the designer and operator.

From the very nature of the process, fractional distillation lends itself to mathematical treatment, and Sorel's famous studies have been extended by the brilliant work of Lewis, Van Nuys and others. It is also possible to approach the subject from a less mathematical angle, and this is the method adopted by Ernest J. Winter in a series of articles on the fundamentals of fractionation, the first of which appears in this issue. Every chemical engineer should have a clear conception of the mechanism of fractional distillation, and we feel that Mr. Winter's method makes this possible, even for those who have difficulty in visualizing mathematical functions.

A Distinguished Honor

Dr. Reese Brings to the Office of President of the American Institute of Chemical Engineers a Wealth of Background, Experience and Personality

Charles L. Reese

Newly Elected President of the American Institute of Chemical Engineers

WHEN an organization like the American Institute of Chemical Engineers elects a president, the honor usually falls to a man nationally known both in the industry and out of it. Charles L. Reese is no exception to this rule. As chemical director of the du Pont company before, during and since the war, he has developed men, organizations, plants, processes that are his spokesmen.

Several years ago an interesting conversation took place which better than anything else perhaps will illustrate Reese's service to his company, to the industry and to the nation. A chemical engineer was talking to one of the technical men of the du Pont company.

"Did Dr. Reese have anything to do with Hopewell?"

"Sure, he was in charge of the work."

"I know, but that doesn't necessarily mean anything. He might be in nominal charge and not even be able to design or operate a nitric acid plant."

"Well," replied the du Pont man, "I think if he were urged, Dr. Reese could draw up a set of plans for a nitric acid unit, but you can get plenty of younger men to do that pretty well. In an enterprise like Hopewell there were a good many other things to do. Someone had to look over the plans, not only the blueprint specifications for equipment and layout but also the economic substructure. Where shall the plant be located most advantageously? What are the special conditions of the location that need to be met? Who in the organization shall be selected to design the plant? Are there any economic factors involved in the designs, such as shortage of specific raw materials or equipment? These questions of policy, budget and personnel are vastly more important in an organization like du Pont than the question of design and operation. Without these things as strong foundations no amount of intelligent design and construction is effective. And that is the way Reese works in the du Pont organization."

There is a message and a lesson in Dr. Reese's biography. For 16 years after his graduation from the University of Virginia and until he was 38 years old he was a student and teacher of chemistry in various colleges and universities. His Doctor's degree was taken at Heidelberg under Victor Meyer and his last academic position was on the faculty of Johns Hopkins University. Many papers were published by him in various scientific journals on a variety of subjects, and these stand now as substantial evidence of his familiarity with scientific thought and the research method.

Then came a change into industrial work and an opportunity to apply these assets to industrial problems.

The success of his first industrial effort brought with it increased opportunity with the du Pont organization and called into action not only the talents already displayed but a native executive ability. In the 21 years of service with du Pont, first as head of a small chemical research laboratory, later as chemical director in charge of enormous developments such as the du Pont company undertakes, and finally, in recognition of his services, as a director of the company, Dr. Reese's career is a challenge to those who believe that a training in pure science is inadequate for industrial success and technical efficiency.

Yet another picture will serve both to illustrate and instruct. It shows another quality essential to great achievement—imagination. The Institute had spent several days in Washington inspecting the laboratories of the various departments of the government that serve industry. Dr. Reese as president-elect was called on for speech at the dinner. After a tribute to the existing government bureaus engaged in industrial and scientific research, he developed the idea of a bureau for medical research. Imagine a hospital with a thousand beds and adequate equipment. Picture for yourself a Rockefeller Institute on such a scale as that, backed with government appropriations, attracting to it such men as Carrel, Mayo, Crile; and developing a type of medical research man that is unfortunately most uncommon. Such a bureau could focus its effort on tuberculosis, cancer, preventive medicine, diet, senescence and be of direct service to every person in the country. Why should we not direct the same intelligent far-sighted work to the study of the human body that we now put on industrial research? This is the picture Reese painted that night—a picture warm with enthusiasm, colored and vitalized with that rare gift of imagination. It is part of the picture we should like to leave with you of the president of the American Institute of Chemical Engineers.

Federal Investigation of the

Chilean Nitrate Industry

Review of Technical Sections of Department of Commerce Raw Material Survey Dealing With Methods of Recovering Nitrate From Caliche

WITH the exception of one plant, all those in the nitrate region that are in regular operation are built for the Shanks process. At the Delaware oficina, a modification of this, designed by A. W. Allen and known as the Allen process, has now been in successful use for more than a year. At the Cecilia, Guggenheim Bros. have an experimental plant treating trial lots of caliche by a radically new process, and at nearly every oficina on the pampa some modification of the original Shanks process has been or is being tried.

Essentially the Shanks process is one of treatment of coarse-crushed rock by counter-current leaching, the aqueous solution being brought up to strength and temperature to boiling point, decanted, cooled, and returned for re-use. The caliche contains a number of water-soluble salts, of which sodium nitrate and sodium sulphate are most important. It happens that the solubility of sodium nitrate increases with rise of temperature at a much greater rate than does that of sodium chloride. Indeed, at the higher temperatures involved, the solution in the presence of caliche will precipitate sodium chloride and take up additional nitrate. The nitrate-rich solution is then drawn off, clarified, and allowed to cool. As the temperature falls, nitrate crystallizes out, the other salts being retained in solution. The excess solution is drawn off, the nitrate drained or put through centrifugals, and the liquor sent back for re-use.

These are the essentials of the process, but there are many minor complications and side processes, such as those involved in precipitating "high potassium" nitrate, "96 per cent" nitrate, "98 per cent" nitrate, recovery of iodine as a byproduct, hastening precipitation, recovery of heat, and other similar matters. In general, however, the plants are operated to produce the standard 95 per cent nitrate with the minimum of loss in the refuse and the highest speed of treatment (to secure plant capacity) consistent with making acceptable recoveries.

In the treatment of caliche it is to be anticipated that the present wasteful method will give way to one which will result in an increase of yield on the average of about 25 per cent from the same material. It is entirely probable that this can be done with less fuel than is now used. . . . The larger recovery and probable lower treatment and overhead costs will permit working lower-grade materials and so will increase the yield per acre.—*Abstract from summary of report.*

As much as 90 per cent has been recovered at times already, and in view of what is done regularly elsewhere there is no prohibitive reason why this should not become the rule.—*Abstract from report.*

The essential parts of the plant or maquina, to use the local term, are the crushers, treatment tanks, clarifying tanks, cooling tanks, and storage platform. To these, evaporators and centrifugal machines are added by some companies. The caliche is crushed coarse, to 3 or even 4 in. only. The treatment tanks are rectangular, made of steel and rarely insulated. They hold 80 to 90 tons of caliche each, are heated through internal coils by low-pressure steam generated directly for that purpose or reduced to pressure by passage through the power plant and are emptied by hand. The solutions are moved from place to place by gravity, aided by pumps or air lifts. The classifying and crystallizing tanks are large flat-bottomed steel vats set high so as to allow circulation of air under, over and around them, and the storage platforms, or canchas, are mere earthen terraces on which the nitrate is dumped from cars or overhead belts.

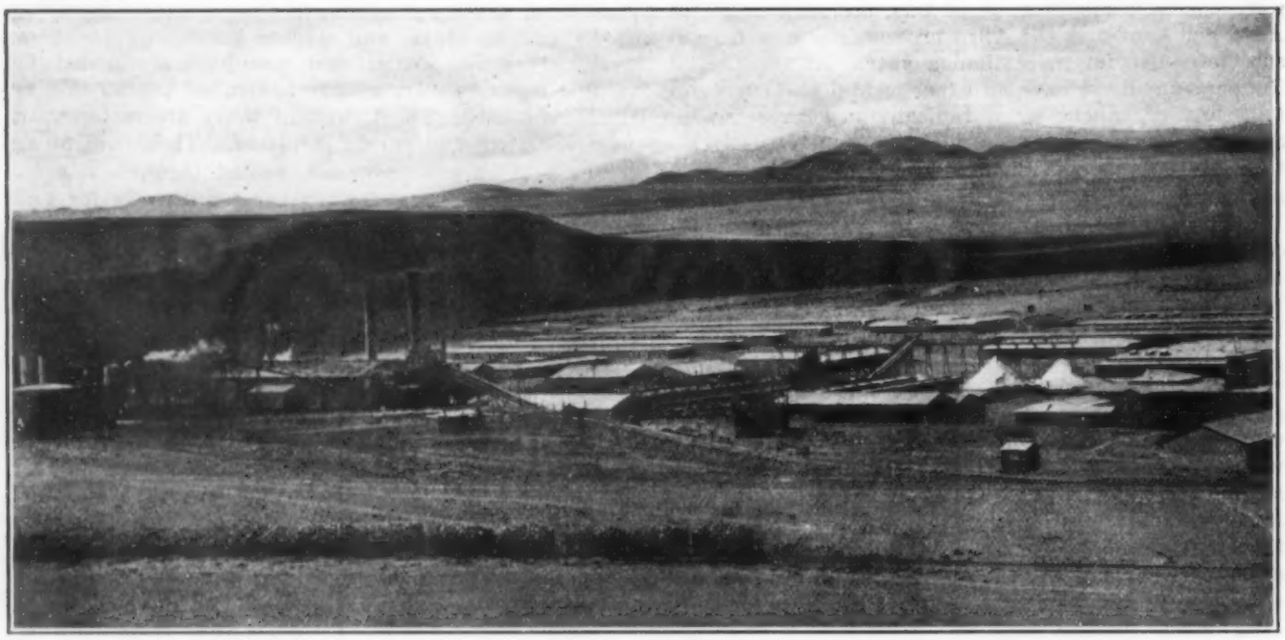
The process and its various defects and difficulties have been described in detail by many writers, and no good purpose would be served by repeating here what is so readily available. Essentially, the present difficulty is that it is necessary to treat caliche of much lower grade than that to which the process is really adapted. With pure or even high-grade mixtures of salts, it is a cheap and effective method of separating nitrate from other salts. Now, however, from 60 to 85 per cent of the material which goes into the tanks is barren or waste. This not only absorbs heat—and the cost of fuel accounts for approximately half the treatment cost—but it absorbs and carries off to the tailing pile important amounts of the nitrate even after the latter has been brought into solution. Many of the caliches impose particular difficulties in treatment because of the presence, or its formation during the treatment, of what is locally called borra. This corresponds in general with what the cyanide expert knows as slime, and consists in part at least of fine particles of clay deposited in the original beds and released by the crushing and decrepitation of the caliche during dissolution and boiling.

Report on the cost of Chilean nitrate was made by H. Foster Bain, director U. S. Bureau of Mines, and H. S. Mulliken as a part of the general investigation of the nitrate industries carried out under the direction of Harry A. Curtis of the Department of Commerce.

Probably also chemical products are formed from the various salts that contribute to the colloidal character of the mass. This character, coupled with the fact that the solution is not pure water but one of high specific gravity as a result of the load of various salts taken up, makes it difficult and expensive to decant clear solutions, to wash by displacement as the solution moves forward in the series of tanks, and finally to wash the residue clean. Filtration of the finest material has proved impossible as a practical commercial matter, though at a few plants, by mixing what the cyanide chemist would call sand and slime, nitrate is recovered that would otherwise go to waste.

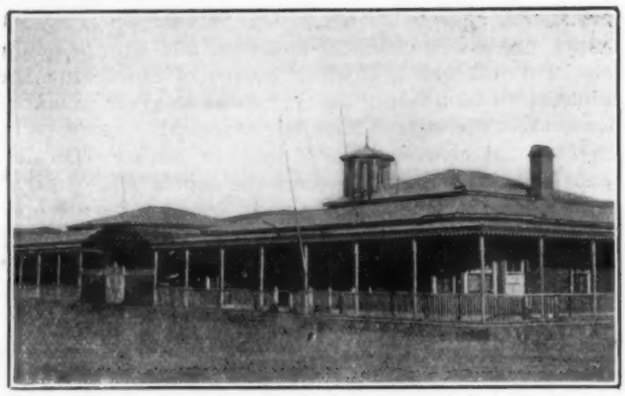
The net result of all this is that, when the exact facts are known, the recovery of nitrate in the caliche treated ranged from 55 to 75 per cent. With favorable material, and in special cases, higher recoveries are made, but for the industry as a whole the recovery is undoubtedly of the general order of not more than 65 per cent. It is difficult to speak with entire accuracy with regard to percentage of recovery and accordingly of cost of treatment, because, as Professor Donnan and others have pointed out, the methods of sampling generally in the nitrate field are most primitive and inaccurate, and the chemical control of the treatment is slack to an almost unbelievable degree. It is not necessary to labor the point. The facts are beyond controversy and are recognized by the men actually in charge of the work. Owing to historical reasons, non-resident ownership has so far been common, the staff allowed has been small, and most of the members poorly paid; and financial rather than technical control has been emphasized. These conditions are changing slowly, but the recovery now common is admittedly low, and the cost is known to substantiate the statement that 35 per cent of the nitrate hauled to the crushers is now lost in process of treatment in much the larger number of plants. This is not necessarily a severe indictment of past management. It is but a few years ago that the saving made at the big porphyry copper mines of the United States was of the same order, though it is true the value of the material in the ground was then less. The copper companies concentrated talent and energy on the problem of better recovery, and this is now 85 to 90 per cent. The inherent difficulties in the case of treating copper ores were greater than are those in the case of nitrate, and at the time the value of the additional material that might be saved was less. It cannot be doubted that similar persistent and equally able research can increase recoveries in nitrate treatment a similar 20 to 25 per cent, reducing the real loss to 10 to 15 per cent regularly and generally.

As matters now stand, the general recovery throughout the industry may be taken for purposes of study at 65 per cent and the cost per ton of caliche treated as of the order of 60c. gold. Of this approximately half is the cost of fuel, and 90 to 95 per cent of the fuel cost is for heating solutions. The amount of power used is small, being of the order of 3 to 5 kw. per ton of caliche treated. It is a curious circumstance, due perhaps to the general presence in the field of master mechanics and the absence of chemical engineers, that attention has been concentrated on reducing power costs rather than heat losses. Hydro-electric, central Diesel-engine plants and high-grade steam turbines have all been built and are in use. All this is highly desirable, though the resulting power costs are still high, and at a few places the elaborateness of the equipment, measured against the amount of power used, raises questions in the visitor's mind. Certainly the possible saving here is small as compared with heat wastage at other steps in the process.



First Nitrate Plant in Chile to Be Remodeled to Operate by New Hot Leaching Process—Oficina Delaware, Taltal

The fuel used is now almost entirely petroleum, which comes from Peru, Mexico and California. The amount used varies, but is of the order usually of 1 ton of fuel oil to from 35 to 50 tons of caliche treated. To the cost of the fuel at the coast it is necessary to add from 20 to 50 per cent to cover inland transportation. It may be noted in passing that the substitution of petroleum for coal has taken away from the steamers a large part of the down freight with which they balanced the outgoing shipments of nitrate. Now tankers take petroleum to Chile and go away empty. Freighters go down



Staff House at a Nitrate Oficina

empty, or largely so, and come away loaded. In the long run this must affect ocean freight rates on nitrate, though the loss is more than balanced by the superior heating power of petroleum, economies in burning it, and the benefits flowing from specialized equipment in transporting and handling it.

The amount of labor employed in the treatment plants can be reduced in many instances, and there is room for a larger use of labor-saving machinery in handling material into and through the plant. This is limited, however, by the present necessity of batch treatment in relatively small tanks, and the latter are required because of the difficulty and high cost of heating the material of the character handled, in large lots. It will be necessary to get away from a process involving boiling[1] before such large tanks and mechanical handling as are used at Ajo and Chuquicamata, with their resulting economy, can be introduced. The economies from larger-scale operations are small when the larger plant consists merely of a multitude of small units.

The cost of operations in the plants now in use is largely a matter of capacity, and that in turn depends upon the character of the material. It is not uncommon to find plants operated at 70 to 80 per cent or less of their rated capacity because of the slow rate of treatment required to prevent undue losses in slime. It is also common to find plants making high tailing losses in an effort to bring up the output to some predetermined standard. The character of the caliche as regards leachability is the controlling factor, and practical operation consists of balancing cost against loss to obtain the best results. . . .

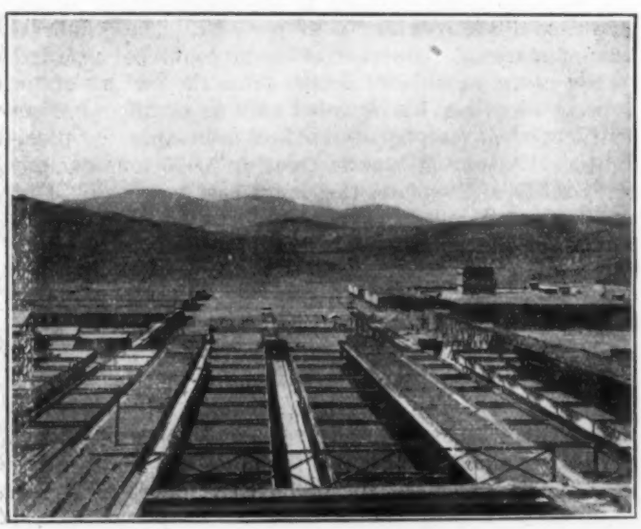
While there are a number of projects in view for improvement in treatment, and various new processes or steps in process undergoing test, no attempt will be made here to review them all; but the Allen process, as developed at Oficina Delaware, and the Guggenheim process, tested at Oficina Cecilia, as being especially promising, warrant a few words. A. W. Allen has discussed the general principles involved in a small book easily available[2] and at Oficina Delaware, after studies and tests made by him, a process has been put into use that embodies many of the principles brought out by him. In particular, finer crushing, upward displacement of solutions, and the heating of the latter outside the boiling tanks, have been employed. The process involves making what is known locally as a caldillo, or less than full-strength solution in the former boiling tanks[3], and bringing it up later to full strength by evaporation. Careful tests on a working scale showed that with good leaching caliche recoveries of as much as 90 per cent of nitrate can be made in this way. In practice the recovery falls below this by various percentages, depending upon the character of the material available for the tank charge, but is still markedly higher than was attainable on the same caliche with the Shanks process. While therefore in practice not, as yet, entirely realizing the hopes aroused by it, the Allen process none the less marks what is perhaps the greatest improvement reduced to practice in nitrate recovery in years. It has the further advantage that it is applicable to existing plants, which can be adapted to it without complete rebuilding. It does not solve all the difficulties of the nitrate producer, but if widely adopted it should result in marked increase in yield with but moderate expense for reconstruction.

The Guggenheim process is more radical in its conception, and to realize its benefits it will be necessary to rebuild entirely and on a large scale. However, in

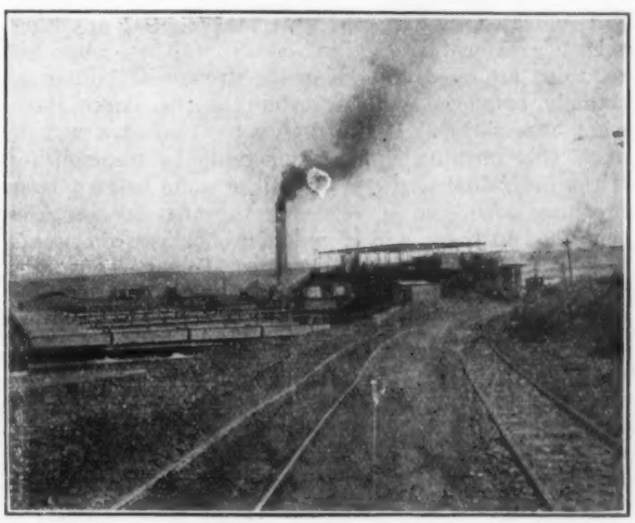
[1] As has been done at oficina Delaware.—EDITOR.

[2] "Recovery of Nitrate From Chilean Caliche," 1921. J. B. Lippincott, Philadelphia.

[3] The repeated reference to "boiling tanks" is misleading. According to the booklet referred to, the process involves the use of a leaching vat of suitable dimensions, not equipped with steam coils or other provision for the boiling of the solution. In the first application of the process, at Oficina Delaware, the cachuchos were remodeled to operate by the new process for the recovery of nitrate from borriente caliche untreatable by the Shanks process.—EDITOR.



Crystallizing Vats, Staff House and Native Quarters



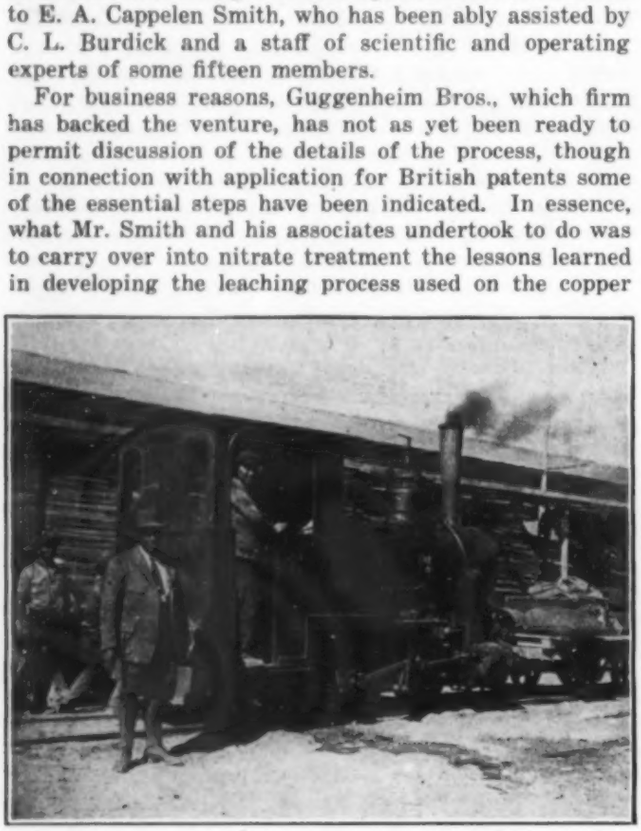
Shanks Process Nitrate Plant

our judgment it offers the largest promise now in sight for making a satisfactory recovery from caliche of widely varying characteristics and in particular from the borriente, or slime-making varieties that are so troublesome. The conception of the process and the pertinacity that has carried it through experimental and semi-commercial stages of development must be credited to E. A. Cappelen Smith, who has been ably assisted by C. L. Burdick and a staff of scientific and operating experts of some fifteen members.

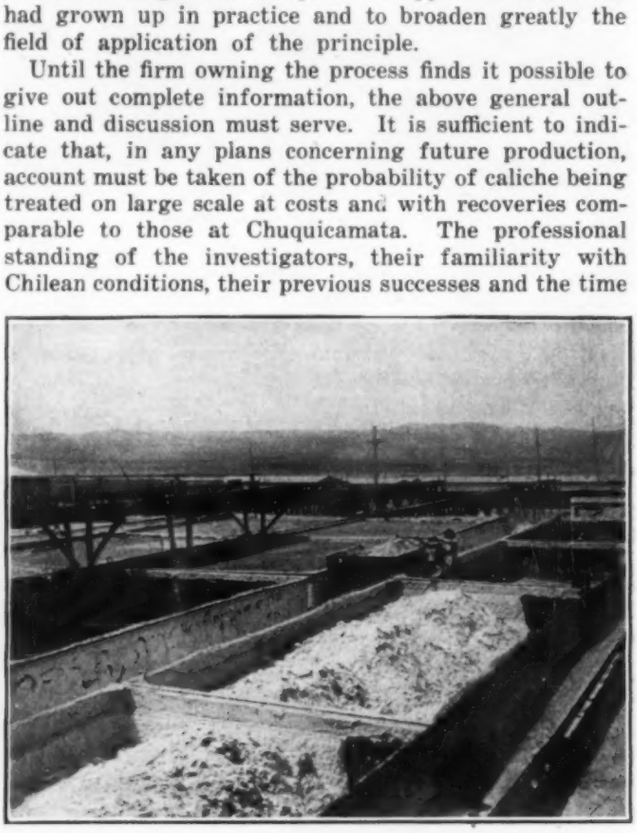
For business reasons, Guggenheim Bros., which firm has backed the venture, has not as yet been ready to permit discussion of the details of the process, though in connection with application for British patents some of the essential steps have been indicated. In essence, what Mr. Smith and his associates undertook to do was to carry over into nitrate treatment the lessons learned in developing the leaching process used on the copper ores at Chuquicamata. . . . Accordingly, the process was developed on the basis of treatment with cold or slightly warmed waters and precipitation obtained by refrigeration in place of evaporation and cooling in open tanks. . . .

There remained, however, one difficulty, that had stood stubbornly in the way of all plans for improvement—the formation of slime. Tests made by others had indicated that in cold water there is, if anything, even a greater tendency to form slime than when hot solutions are used, though in the process of boiling as actually employed[1], the agitation in the tanks somewhat offsets this. It was necessary to find a way to avoid this forming slime. This could be accomplished if the individual particles of caliche could be kept from breaking down and so releasing the fine clay particles contained in them, and if colloidal chemical compounds formed in process could be avoided. What was wanted was a system of leaching using a solution which would take up nitrate and as little as possible of anything else, so as to leave the particles of inert silicates still held in a network of salts other than nitrates of potassium and sodium. It was known empirically, and the knowledge was used in practice, that caliche high in magnesia could be used to balance other varieties high in sodium sulphate, and trouble with slime thereby minimized. The balancing of ions in solution is a well-known process in chemical industry, and this principle has been followed in finding means of stabilizing the solutions to be used in leaching so as to avoid breaking down the caliche and forming undesirable compounds. The careful chemical work done in advance permits exact knowledge here to replace the approximations that had grown up in practice and to broaden greatly the field of application of the principle.

Until the firm owning the process finds it possible to give out complete information, the above general outline and discussion must serve. It is sufficient to indicate that, in any plans concerning future production, account must be taken of the probability of caliche being treated on large scale at costs and with recoveries comparable to those at Chuquicamata. The professional standing of the investigators, their familiarity with Chilean conditions, their previous successes and the time and patience they have devoted to the work give every reason for confidence in their success. Incidentally, it may be added that they have already treated eight to ten times as much caliche as they had Chuquicamata ore before building of the plant at the latter place was begun.



Locomotive Used to Haul Caliche to Small Plant



Typical Crop of Nitrate Crystals

Preliminary estimates may be made, based on applying Chuquicamata methods to the treatment of nitrate and raising the recovery to 90 per cent. These indicate that a material reduction of costs could be expected. While in the absence of details from the owners of the process these can be regarded only as outside approximations, they may be repeated as indicating the possibilities. Assuming a plant treating 5,000 tons per day with a life of 20 years, the prime cost may be built up as below: Mining, 49c.; transportation, 15c.; treatment, 18c.; administration, 8c.; amortization, 20c.; total, $1.10.

It is entirely possible that the mining cost could be brought below the amount here estimated, all the more since the higher recovery permits treating lower-grade rock, and so would make it possible to relax standards somewhat. The main saving, though, is in the treatment cost, where the ability to handle large quantities permits mechanicalization of the plant and the working with cold solutions reduces the cost for fuel. While more power will be needed, it happens that the amount necessary for treating 5,000 tons per day can be gen-

[1] Internal heating, and consequently boiling, is not practiced at Oficina Delaware with the Allen process; and in many Shanks maquinas an endeavor is made to avoid actual boiling.—EDITOR.

erated at a coast station and transmitted to the field at a price little below that necessary for larger units. This is a price much below that at which power is now made in the field. The amortization charge is lowered because, with ability to treat lower-grade rock, it is unnecessary to buy as much land to secure the necessary tonnage, and now prices are fixed and for some time to come are likely to be, on the basis of nothing containing less than 12 per cent nitrate being worth moving. What ability to save 90 per cent as against 65 per cent means as to tonnage in the ground is suggested by recalculation of the results of the examinations of considerable tracts of ground. In the one case the tonnage was increased in the ratio of 10 to 14 and in the other from 10 to 24.

If caliche containing 14 per cent be treated with a recovery of 90 per cent, 12.6 units will be saved and the ratio of caliche to nitrate extracted is 7.94 tons to 1, substantially the ratio used in the other examples. Accordingly, it would be possible to drop the average grade of the material treated 4½ units and yet operate at a lower cost. Adding the secondary cost of $2.09 unmodified by the slight difference in ratio to the prime cost of $1.10 gives a total cost of $3.19 per ton of caliche, corresponding to $25.33 f.a.s. per short ton of nitrate or $1.26 per hundred, even when working on a lower grade of caliche. Such costs are clearly within the range of probability within the next few years.

Construction Costs Computed

The following calculations are made for the convenience of American readers, in terms of the 2,000-lb. ton, with values stated in terms of American dollars. For purposes of conversion, Chilean pesos have been taken at 12½c. and British shillings at 23c. These happen to have been their value in July, 1923, when the study was made. The figures may be easily converted at any other exchange considered more sound. The estimate is based upon building a plant to treat 3,000 tons of caliche per day and actually treating 1,000,000 tons per year. This corresponds to working at 91 per cent capacity 360 days in the year. While the holidays observed in Chile are few and 360 days is attainable, it may be objected that no plant works at 91 per cent capacity through a term of years, and that accordingly a larger plant should be built or a larger allowance made for idle time. Reasons have already been given why in the nitrate industry it is more economical to run steadily and store product than to expand and contract the scale of operations through the various seasons; and, with good management, plant capacity must be kept as nearly as may be to actual anticipated output. If the excess capacity be considered too small, that excess can be doubled and still only affect the amortization cost per ton treated to the extent of one cent. If it be objected that in the course of the anticipated life of the enterprise one or more idle years would, on the basis of past history, seem probable, the effect would be merely to defer the returns for the succeeding years. In the absence of knowledge as to what idle period might be anticipated, it is impossible to give a numerical expression of this decrease in value. It would depend mainly on which of the terms of years was the idle one. At present there is no plant in the region that is capable of treating 3,000 tons per day, although one is being built, and a 5,000-ton plant is under consideration. There are a few 1,000-ton plants, a number that treat 750 tons, and many of 500 tons and less.

The construction cost for such a plant as is indicated may, it is believed, be taken as $4 per ton of annual capacity. There is much uncertainty as to what would be the present cost of building a new oficina. In pre-war days oficinas were erected for as little as $2 per ton of annual capacity, and an unusually complete and well-built plant was opened shortly before the war at an investment cost, aside from lands, of $3.30. During the war plant costs more than double that were incurred, and material costs are now certainly higher than in the pre-war period, while somewhat below the peak of war prices. Ocean freight rates for the present are at or below pre-war prices. Both British and Chilean exchange favor Americans spending money abroad, and a considerable part of the final cost of any new plant would be paid in foreign currencies, even though the machinery, steel, cement and other materials might be bought at home. While the figure of $4 per ton, corresponding by hypothesis to plant investment of $4,320,000, is open to question, it is felt that it is sufficiently near probable cost to serve the present purpose.

Better Insecticides Sought

One of the most important fields of activity of the Bureau of Chemistry of the United States Department of Agriculture is the work the bureau is doing to develop effective and cheap insecticides and fungicides for the control of insect pests. As crop production becomes more intensified, new biological problems arise in the attempt to maintain an equilibrium that will be of benefit and profit to man. Some of our most acute agricultural problems originate from insect depredations or from plant diseases transmitted or stimulated by insects. The work the Bureau of Chemistry is doing in chemical research of insecticides and fungicides, therefore, has a tremendous economic significance. This is being recognized and is being developed and expanded as rapidly as possible.

A study is being made of foliage injury by arsenicals and other insecticides and fungicides in order to develop spray materials which, while acting in an efficient manner, may be applied to tender foliage without injuring it. Owing to the importance which calcium arsenate has assumed in the dusting of cotton for the control of the cotton boll weevil, an extensive investigation of the physical and chemical properties upon which its effectiveness depends is being made. The field work conducted at Tallulah, La., during the year has resulted in two achievements of importance—the development of a quick test for detecting high water-soluble arsenic in commercial calcium arsenate, and the discovery that the dew on cotton plants contains relatively large quantities of plant exudate, which compounds, in the presence of moisture, decompose calcium arsenate, thus affording a possible explanation of many cases of unanticipated plant injury which have been observed in the dusting of cotton.

The demand for calcium arsenate for boll-weevil control has had the effect of greatly increasing the price of arsenic and arsenicals. This is now a serious matter for fruit growers and others using arsenic in some form for the control of insect pests, and it is likely to develop into a more serious one. Work is being actively prosecuted in the chemical technology of arsenical production for the purpose of discovering methods for lowering the cost of production. Some very suggestive results have already been obtained.

Chemical Engineering Methods in

Processing Dried Fruit

Formation of Co-operative Association in Raisin Industry Permits Application of Aggressive Technical Methods—Design of Conveyor Drying Equipment and Automatic Control of Temperature Interest Chemical Engineers

By A. W. Allen
Assistant Editor, *Chem. & Met.*

THE center of the raisin industry of the United States is at Fresno, Calif., its control is in the hands of the Sun-Maid Raisin Growers—an organization that has revolutionized methods of handling and preparation. The following notes comprise condensed abstracts from company publications, contributed in large part by E. J. Hearhart, of the manufacturing division, supplemented by additional data and comments, the outcome of a visit to the plant at Fresno.

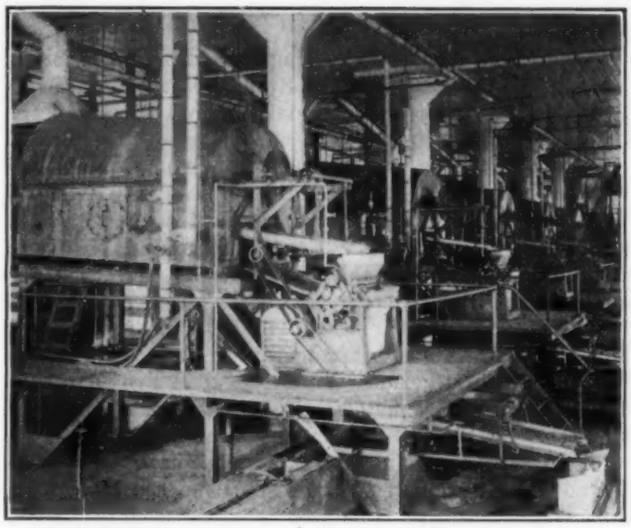
When a new raisin territory is developed sufficiently, a receiving plant is erected. Here the fruit is inspected and weighed, then shipped to the nearest stemming or packing plant, of which there are twenty-eight. The raisins are delivered by the growers in what are known as sweat boxes—2 ft. by 3 ft. by 8 in. high, the delivery season starting in September and ending late in January. After passing the inspector, the raisins are unloaded into a conveyor and go to the stemmer (which removes the large main stem), consisting of a stationary concave screen and a screen-covered cylinder revolving at 340 r.p.m. The space between the cylinder and the stationary screen varies from 3 in. where the raisins are received to 2 in. where they come out. They are carried through by a revolving cylinder, the stems being rubbed off in the process by contact with the screen.

The raisins and stems then pass to a vibratory table, off the end of which they are shaken, through a blast of air that blows all the dirt and stems over a baffle board. A device known as the stem picker reclaims the few raisins that are blown over with the stems.

Muscat raisins from the stemmer are graded by means of a machine fitted with four screens, each one being set about 6 in. directly under the one above. These screens are mounted on springs so that the set is given a shaking movement. The smallest muscat raisins (commercially known as "one crown"), together with the cap stems that have been shaken off, are treated by a flotation process, whereby the good fruit falls to the bottom of a receptacle filled with water and is removed by drag, and the foreign matter and immature raisins are floated off. The selected raisins then go to a reclaimer, which consists of a cylinder covered with wire screen, inclosing eight steel paddles mounted on a central shaft moving at 1,750 r.p.m. The paddles are set at an angle, so that the raisins are thrown and rubbed against the screen before they are discharged. During this process the remaining cap stems are removed and fall into a refuse box. The raisins are then packed for shipment.

Sales of seeded raisins in a recent year amounted to about 50,000 tons, from which an idea of the immensity of the industry and the importance of efficient equipment may be gained. Only the larger grades are seeded, but in this case after a dehydrating process. The drying rooms are 60 ft. long, 23 ft. high and 8 ft.

Sun-Maid Raisin Plant at Fresno

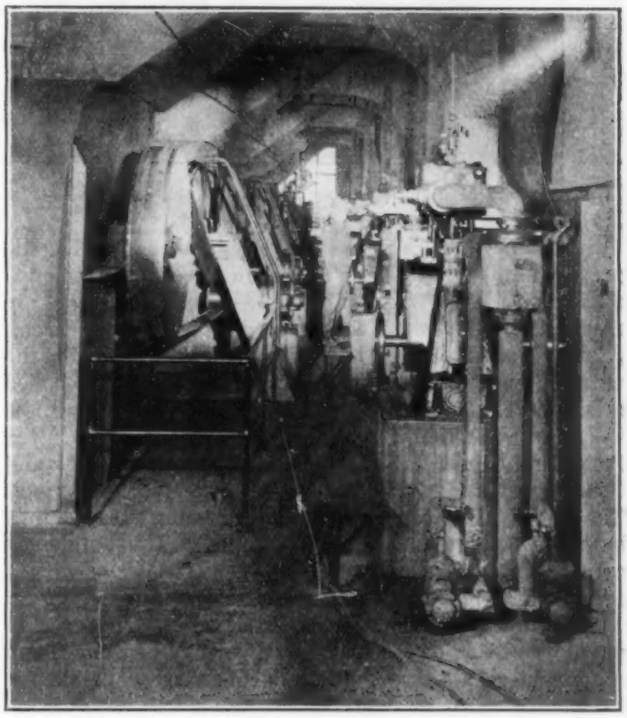


Processors and Seeders at the Fresno Plant

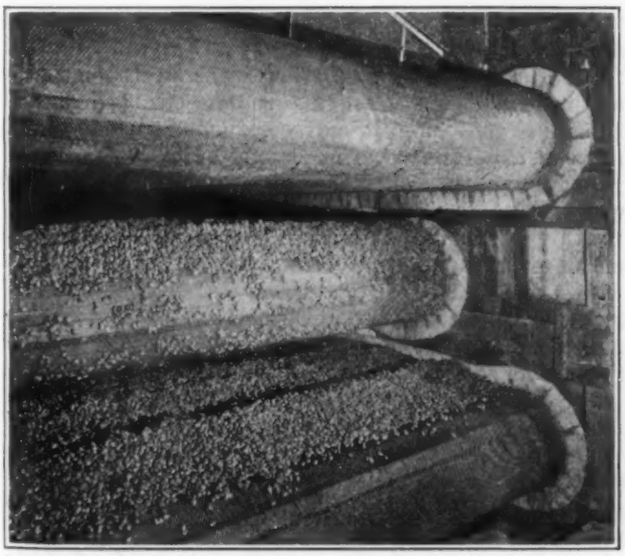
wide, and are divided, by horizontally moving shelves of wire mesh or draper cloth, into eight levels. These shelves comprise in the aggregate an endless belt of screening, the movement of the adjacent shelves being in alternate directions. The belts are stiffened by angle-irons at 3-ft. centers, and are supported on roller chains at each end, running in iron channels. The three larger sizes of raisins from the grader are elevated to the top of the drier and spread evenly on the top draper. They then travel the length of the room and are deflected off in such manner that they fall into the draper below, which is traveling in an opposite direction. This operation is repeated until the fruit leaves the eighth draper, after having been subjected to a blast of cold air.

The hot air, at 160 deg. F., enters below the seventh draper and moves upward at 150 ft. per minute. As the raisins pass downward they come in contact with air that contains more heat and less moisture. If the process is carried out properly, the raisins will not "sugar" after being packed. A chemical change, known as carameling, occurs during the process, which prevents subsequent reversion of the sugar to its original state. It is a desirable change in many ways: The raisins are hardened, thus permitting the easy removal, by mechanical means, of the cap stems; the seeds are more readily removed from the fruit, with minimum loss; quality and flavor are improved. In the Fresno plant there are ten of these driers, each having a capacity of 30 tons in 8 hours.

The cap stemmer used for muscat raisins, other than of the one-crown variety, which is placed below the discharge from the eighth draper in the drier, differs from the large stemmers in that the revolving drum and the concave around it are cone shaped and placed vertically. The drum also revolves at a much higher speed (650 to 800 r.p.m.). The raisins enter the top of the machine; in this the stems are knocked off, and drop through onto a shaker, from which the fruit is discharged through a blast of air, to remove the débris. The clean fruit then goes to a processor, consisting of a vessel inclosing a trommel with spiral discharge. The vessel is kept about one-fifth full of water at about 200 deg. F., the temperature being regulated by steam control. The maintenance of the correct degree of temperature was found to be so important that recording thermometers are now used, although not shown in the halftones. These are supplemented by automatic heat control apparatus, thus avoiding the necessity for personal manipulation of steam valves for the regulation of temperature.

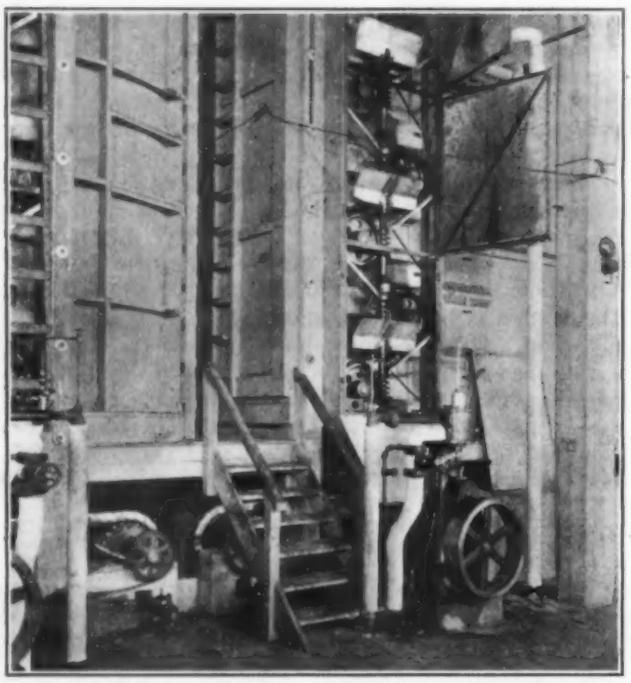


One Section of the Drying Floor



Horizontally Moving Shelves Carrying Raisins Through the Drier

The raisins leave the processor in a moist and soft condition, and are delivered to the seeders. These are ingenious machines, each consisting essentially of four rolls—two of rubber, one of fine metal teeth and known as the seeder roll, and one of coarse metal teeth and known as the flicker roll. The raisins are crushed between the seeder roll and the two rubber rolls, the meat being pressed between the teeth, the seeds being forced through the skin and removed by the flicker roll. The raisins are pulled out of the teeth, put into shape, and delivered to a shaker feeder, from which they are delivered to various parts of the building for packing.



Mechanical Equipment for Driving Moving Shelves

Subsidiary processes for special markets include preparation of the Thomson raisin by dipping in olive oil, or bleaching with sulphur or soda. The soda dip cracks the skins, with the result that drying is accomplished quickly. The Jewish holiday season in the autumn synchronizes with a heavy demand for bleached raisins. The Italians in the United States also buy them in quantity. Other varieties of the fruit handled in the factories include sultanas, valencia raisins, malagas and feherzagos, and dried black grapes of various types. The stems, stem caps and seeds are being treated in a byproduct plant and alcohol obtained. The residue is pressed into slabs and used as fuel. It burns with a bright flame but has a remarkably low thermal value.

The industry has come to the front during recent years by reason of the technical efficiency of control and the business ability of those who are responsible for the management of operations. Rome was not built in a day, but the California raisin industry seems to have attained industrial importance almost over night. Its rapid growth connotes a need to anticipate and solve many problems, technical and commercial; but it should be thankful for many natural advantages, including cheap hydro-electric power and abundant sunshine, and the fact that expansion to present dimensions occurred at a period of history when chemical technology was alert and vigorous.

To Appraise Waterproofing Materials

The exposure tests that the Bureau of Standards is carrying out on a number of proprietary and non-proprietary waterproofing materials to determine their relative effectiveness and durability under actual weather conditions are still in progress. The first of these tests has now been under way for 3 years. It is hoped that a report of the results obtained at the end of 2 years exposure will soon be available as one of the publications of the bureau. This paper will describe the results of more than 4,000 absorption tests on treated specimens of limestone and standstone.

Seek Improvement in Nickeling Steel

A program of nickel-plating experiments is being undertaken by the Bureau of Standards with a view to finding the best process for making protective coatings on steel. A large number of specimens of steel are to be plated, and the procedure will be varied from the standard conditions in many different ways in order to test the effect on the product of these variations. After plating, the specimens will be subjected to tests to determine their resistance to corrosion and to other adverse conditions that nickel-plated ware is expected to meet. A few other tests will be made with nickel plating on brass and other metals in order to learn to what extent the results found for steel are generally applicable to other metals. From 6 months to a year will probably be required for the tests.

The program is being carried out in co-operation with the advisory committee of the American Electroplaters' Society, a committee appointed from the society for the purpose of co-operating with the bureau and which meets at the bureau twice a year to discuss results and recommend investigations. The last meeting occurred on Nov. 16 and 17, 1923, and at that time the program was outlined by members of the bureau staff and approved by the committee.

Cold-rolled steel is to be used for all the tests, as it is considered desirable to have them all made on one material. In addition, the normal procedure will, in a few instances, be tried on brass. The normal procedure consists in the electrolytic cleaning of the steel and then plating it in a solution of nickel sulphate (140 grams per liter), ammonium chloride (13.5 grams) and boric acid (15.5 grams), the solution having a hydrogen-ion concentration of 5.8. Ninety-seven per cent commercial anodes will be used, the temperature will be 70 deg. F., and the current density 5 amp. per sq.ft. The specimen will be plated for an hour, resulting in a coating of 0.00025 in. thickness. One side will be buffed.

Variations in preparation will be tried, such as cleaning in hot alkali, sandblasting, etc.; preliminary plating with copper, zinc and cadmium will be tested, and many variations in the nickel-plating process itself will be experimented with, such as changing the temperature, current density, composition of solution, etc. Different kinds of anodes will also be tried.

When completed, the deposits will be examined directly and under the microscope. They will be tested for hardness, for their adhesion to the steel under such adverse conditions as bending, rolling, etc., and for the resistance they offer to corrosion under various conditions of exposure, both indoor and outdoor.

A study of special interest discussed at the meeting was that of the throwing power of various solutions. By this is meant the ability of the solution to deposit nickel on surfaces at different distances from the anode with a minimum of unevenness in distribution. It might be expected that any solution would put more nickel on the outside of a hollow article that it does at the bottom of a cavity, the proportion varying inversely as the distance of the surface from the anode. But it is found that this inverse law does not hold and that some solutions give a more even deposit than do others. This results in economy of time and materials, and improvement of the finished product. If the throwing power is poor, the parts of the object near the anode receive an excessive amount of nickel if a coating of adequate thickness is put on the more distant parts.

Waste Elimination by the

Rotary Kiln for Lime

Installation at Bellefonte Plant of the American Lime & Stone Co. Produces High-Grade Lime From Material Unburnable in a Shaft Kiln

BY CHARLES WADSWORTH, 3D.
Managing Editor, *Chem. & Met.*

BEFORE we begin to talk about the technology of the rotary kiln, it will be a good plan for us to consider its place in the lime industry. The rotary kiln was first used on calcite limestones that were found to be too brittle for the shaft kiln. When calcite was burned in a shaft kiln, it pulverized and clogged the shaft. Even the rotary was not very satisfactory in handling this material; probably its pulverizing prevented proper burning. The idea then developed of using a rotary kiln for burning the "fines" which could not be burned in a shaft kiln and therefore were largely waste material. The early attempts about 1913 could not have been overly successful, as the use of the process has not been greatly extended. Therefore it was with great interest that the large rotary kiln of the American Lime & Stone Co., the largest, by the way, in existence on such work, was watched. It is safely over the experimental stage now, and successfully launched on large-scale production. Under the special conditions at Bellefonte, which involve a very pure stone, it has proved eminently satisfactory, but its future in the industry is still a matter of conjecture. In the satisfactory handling of fines, it has a definite and large use. Even here, however, it will be limited by the impurities of the limestone, for high percentages of alumina and iron form a fusible slag or cement in a rotary kiln. Whether it will eventually displace the shaft kiln is pure guesswork. If it stayed in its present state of development, it undoubtedly would not. It does not seem likely that it will remain stationary, however, and it already has the distinct advantage of saving labor.

With this as a background, let us visualize the conditions at Bellefonte. First, the limestone for the rotary is mined stone. It comes from a remarkable bed set at an angle of 58 degrees from the horizontal and

Fig. 1—The Limestone Vein, Nine Miles of It!

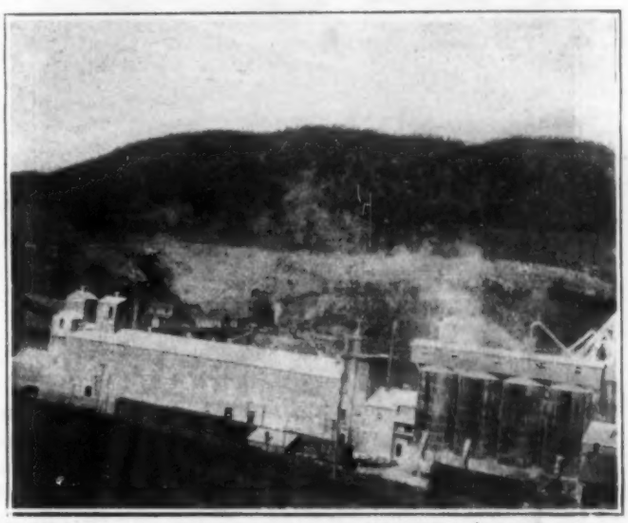


Fig. 2—Calcining Plant
Back of the long building the mine entrance can be seen, where the steam from the donkey engine is going up.

extending down into the earth a considerable and unknown distance. The face of the bed is 72 ft. high, of which 50 ft. is utilized, and the bed is 9 miles in length. Not less spectacular is the purity of the stone, which will average within narrow limits throughout its great area 98 per cent calcium carbonate. The purity and uniformity of the stone have been important assets in perfecting the operation of the rotary kiln, for it has eliminated a very troublesome variable, quarried limestone inevitably containing dirt from the overburden even if the material itself is pure, a condition that is in itself rare.

A WORD ABOUT MINING

A word about the mining may be interesting, although the detailed technique is hardly in our sphere nor within our ability to discuss adequately. The problem, of course, is to remove a layer of limestone 50 ft. thick and tilted at an angle of 58 degrees. Quarrying had been tried without brilliant success and it was finally decided to attempt to mine the stone. At first the stone was worked out in open chambers about 40 ft. high and at various depths, but this was found to be hazardous, as the stone on the ceiling occasionally broke off in chunks and fell none too gently to the floor. Then stope mining was resorted to. This consists in running parallel drifts above one another perhaps 140 ft. apart. Galleries are then run in 20 ft. above the drifts and chutes drilled from them down to the drifts. These are

Fig. 3—The Mine Entrance
The small buildings contain air compressors and the elevator hoisting equipment.

blocked up with wooden gates. Then the ceiling of the galleries is attacked with drills and explosives and the loosened material gradually builds up, forming the floor from which to continue the work. About 40 per cent of the loosened material is drawn off through the chutes into cars, the remaining 60 per cent acting as a loose fill in place of the rock vein. This work is carried on until the roof of the gallery goes to within about 40 ft. of the floor of the drift above it. The cars are pushed on a narrow-gage track to the dumping pit. Here the rock is loaded at the lowest level into cable cars holding 5 tons each that run on 58 degree inclined tracks and is raised to the surface of the mine.

100 Per Cent Mechanical Handling

From the time the stone is loaded into cars until the finished lime is packed in bags or drums there is no hand work except to regulate the flow of material occasionally, and there is precious little regulation necessary. It is distinctly impressive to wander through the plant and see a great many things happening and nobody within gunshot. Some of this is accomplished by the interesting expedient of oversize machinery. Think it over. With plenty of leeway on mills, screens, belt conveyors and bins, it wouldn't matter very much if one unit did not function for a while. The rest of the absence of man power is due to well-regulated automatic controls at various points.

We now have the stone at the top of the mine in pieces varying from 12-in. lumps to fine powder. It is then necessary to reduce this and grade it to three sizes. This must obviously be done in a series of mills, screens and conveyors. We shall follow the course of material very briefly until it is ready for the kiln.

From the mouth of the mine the stone is loaded into narrow-gage cars and dumped into an enormous hopper, at the bottom of which a huge steel roll rotates leisurely. The cars are dumped by means of a compressed air lift such as are common in larger machine shops, rolling mills, etc. That is also an idea worthy of note. A second crusher, of the pestle-and-ring type, reduces the material so that the largest pieces would be of the order of 4 or 5 in. Then a long belt elevator (troughed rubber belt) takes the material to the top of the kiln building. A rotary drum screen eliminates the fines, which go to become ground limestone, road filler or waste (mostly, alas, the last).

The rest of the material is variously divided. That which will drop through 1½ in. is ground no further but is graded into two sizes, 1½ to ¾ in. and ¾ to ½ in. Each of these sizes is stored in a separate bin and burned separately in the kiln. The material that will not pass through a 1½-in. hole is frequently shipped to steel plants for open-hearth charge. Most of it, however, is run from bins to a pan conveyor, which in turn feeds a corrugated roll crusher. The stone is now almost all better than 1½ in. fine. It is elevated and screened again into fines, ½ to ¾ in. and ¾ to 1½ in. This screen delivers direct to the storage bins that feed the kiln, a separate compartment for each size. The fines, of course, are again discarded or ground in tube mills to the "ground limestone" of commerce. There seems to be nothing now in the way of tackling the meat of the subject, the rotary kiln itself.

The Rotary Kiln

A dramatic piece of equipment to look at and to study. Nine feet in diameter, 175 ft. long and set 25 ft. off the ground with the usual pitch toward the hot end, it is distinctly an impressive sight. The heat for burning is supplied from an R. D. Wood Co. gas producer and the lime is, of course, fed in at the cool end. From the bins it runs out on a pan conveyor

Fig. 4—The Rock Elevator
This shows a car of stone being dumped into bins. Thence it flows to the dump cars. Note in back of the elevator the limestone vein, showing clearly the angle of tip.

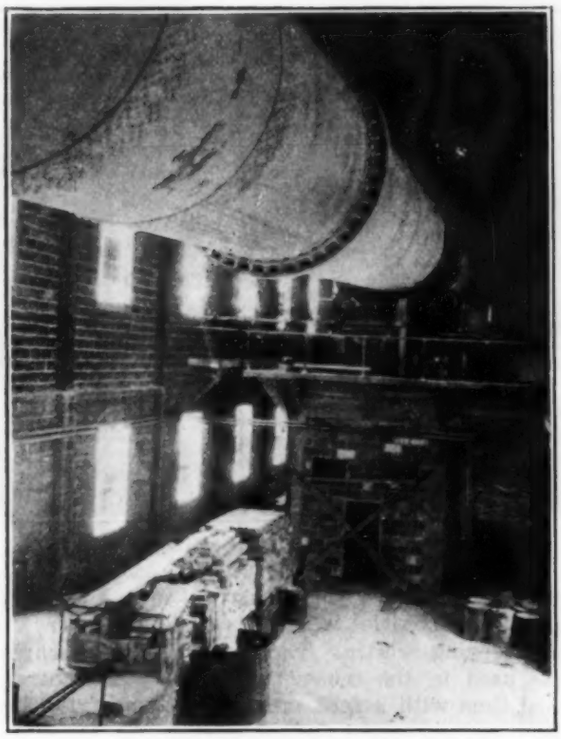


Fig. 5—The Rotary Kiln
This shows the height of the kiln above the ground.

through an opening of regulated size, and the conveyor itself runs at a speed that is synchronized with that of the kiln. The conveyor delivers to an elevator, and this in turn discharges to a chute that leads to the kiln. The limestone passes down the kiln through the burning zone and out over the end of the kiln into a pit below. It is at a yellow heat as it drops into the pit and must be cooled. This is accomplished in a long rotating cylinder divided into four sections by radial plates. The material is thus air cooled to about 100 deg. C. At the end of the drum there is a section of perforated plates that separate the powder from the small lumps or nodules. Both sizes are then conveyed on belt conveyors to appropriate storage bins.

The kiln is lined with refractory brick, and this in itself is a beautiful technical problem. At present a special Laclede-Christie brick with high-temperature cement is being used in the burning zone, and this seems to be fairly satisfactory, although it is too early to give it a clean bill of health. The rest of the kiln is lined with ordinary firebrick. The lining has been put in not by laying half of the brick and then springing an arch across the top but by putting in about two-thirds of the circles with bracing and then slowly rotating the kiln so that all the brick are set in a natural position against the steel. The distortion of the lining by rotation of the kiln is bound to be less than with the other method of construction.

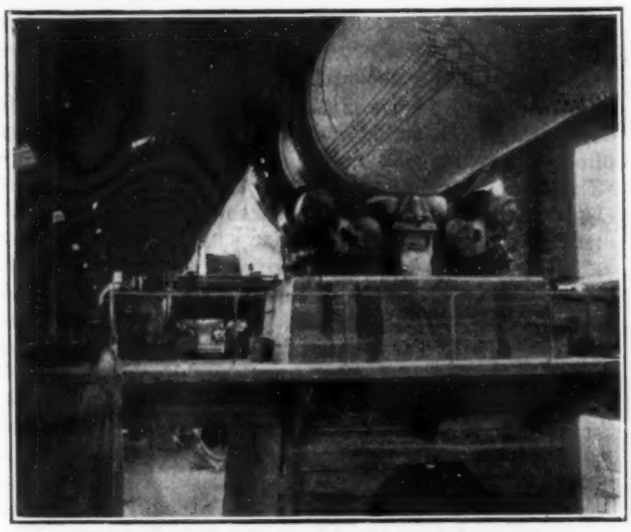


Fig. 6—Center Bearings on the Rotary Kiln

Operation of the Kiln

The operation of this limekiln is probably unique in that industry. It is controlled by the chief chemist on a basis of a laboratory test. This means that more heat or less heat, more feed of limestone or less feed, greater rotating speed or less are carried out on a basis of test. The test therefore is important and interesting.

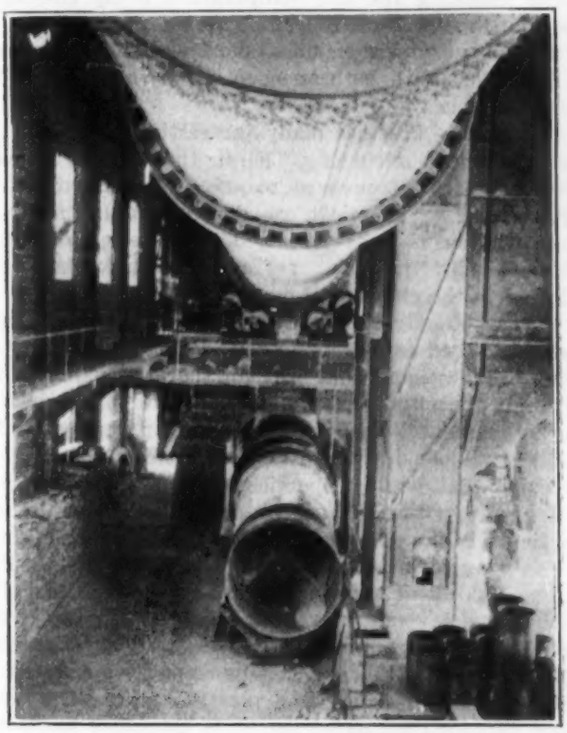


Fig. 7—Toward the Burning End
This shows clearly the rotary cooler below, from which the lime drops into a hopper and thence to a conveyor.

A 100 c.c. sample of lime taken from the mouth of the cooler is slaked with water added gradually in a liter beaker. The slaked lime suspension is poured off and subsequent additions of water are decanted until it is clear. The residue is then poured into a graduate and its volume is noted. Now the interesting fact is that the above residual volume read in per cent corresponds within considerably less than 1 per cent to the total impurities and one-half of it is approximately equal to the carbon dioxide present. That is a statement of fact. It would not be the case with the average limestone that is quarried or that contains impurities, but this pure stone, carrying neither overburden nor clay seams with it, lends itself to such simple control. And again the test would not work on limes that did not slake as quickly as rotary lime.

An additional test will show whether the lime is over-

burned. A little hydrochloric acid on the residue. Overburned lime gives no effervescence, as it is of course silicate of lime. This test is not made if the hot lime in the pit after the kiln looks clear and bright red. Overburned lime and underburned lime both show up in the pit, the one with dark, dull coating, the other with dark streaks.

The control of the burning is relatively simple, since the material is so constant in composition. If the product shows a high calcium carbonate core, the feed must be cut down or the heat increased or perhaps the speed of the kiln decreased, and vice versa. The temperature of the kiln is recorded with an optical pyrometer. The heat unit is a standard producer (Wood) with an automatic (bituminous) coal feed. The temperature at the hot end varies somewhat, but is usually around 2,600 deg. F., with stack temperatures of 1,000 to 1,100 deg. By far the simpler method of speeding up or checking the kiln temperature is by closing or opening the check draft leading to the stack—the gases are led down and then up a short stack and the draft is controlled with both an open check valve and a butterfly damper.

Beyond the kiln are many interesting problems that we shall touch on briefly. First, the lime as it comes from the kiln is conveyed to one of several tanks for agricultural or chemical use depending on the grade. The grading is done largely by the test already described, only the most perfectly burned lime being allowed in the chemical lime storage.

Parenthetically it should be noted that only recently has there been any attempt to grade lime. Not long ago lime was lime and that was all there was to it. But through the efforts of the National Lime Association the fundamental properties of lime are being studied and already considerable progress has been made in discovering just what properties are desirable in certain industries. Other agencies, individual companies and particularly the American Society for Testing Materials are making contributions to our knowledge of this field.

The slaking of rotary kiln lime is another technical problem with some interesting angles. Smaller in size than the average lime, it slakes rapidly, indeed violently, and in a standard slaking apparatus such as the Schaefer, for instance, the reaction takes place much more rapidly than usual and it is therefore more difficult to control. Still another variable is the initial temperature of the lime, which must be kept below a certain point or the particles will react with such violence that casehardening sets in. The same bagging machine as those used in the cement industry is used here for slaked lime with a feed into the bottom of the heavy paper bag.

Fig. 8—The Storage Bins and Slaking Building

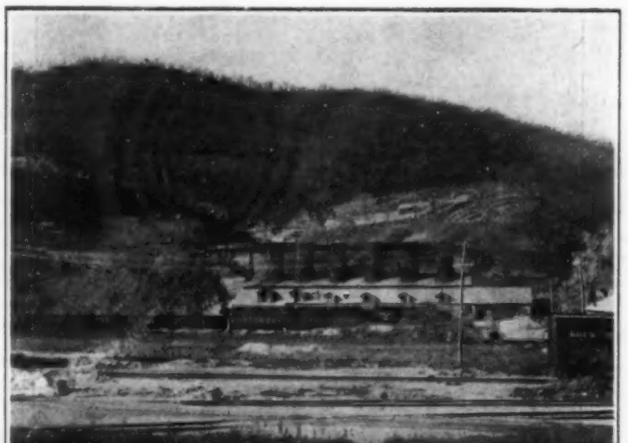


Fig. 9—Shaft Kilns Near By

The lime industry is on the march. It has always had the benefit of intelligent, though for the most part empirical, operation. Now it has enlisted all that science, technology and, perhaps most important, co-operation can give. The rotary kiln is one of the newest developments, but there are others and in other fields than production. Intelligent progressive sales work is having its effect and we hope to tell that story before many moons.

For the opportunity of presenting this story on the rotary kiln we are indebted to W. R. Phillips, of the American Lime & Stone Co., whose co-operation has been cordial and whose attitude is enlightened and forward looking. To him and to the technical men in the plant, David E. Washburn, chief chemist; Fred Kraft, superintendent of the rotary kiln, and G. L. Morris, superintendent of the mine, our great indebtedness is acknowledged.

To Determine Oil-Refining Practice

The quantity and quality of gasoline and kerosene which may be manufactured from a given quantity of a certain crude oil depends largely on the methods used in refining. An investigation of refining methods to determine what fundamental principles should be applied to obtain a maximum yield of gasoline from crude oil is now being conducted by the Bureau of Mines, Department of the Interior, at the Petroleum Experiment Station, Bartlesville, Okla.

M. P. Youker, refinery engineer, assisted by M. B. Cooke, associate refinery engineer, is conducting this investigation. The work has been divided into three general parts: First, a study of theoretical problems and development of fundamental considerations relative to fractional distillation; second, tests in refineries throughout the United States to substantiate the theories involved; and third, tests in a small refining unit, specially constructed at the Bartlesville Station, for the purpose of developing new methods of running. Several actual tests have been run in refineries.

Fusion Welding

Gas and Arc Welding Provide the Chemical Engineer With a Most Valuable Method of Fabrication and Repair

By Clifford B. Bellis,
Assistant Editor, *Chem. & Met.*

THE term "welding" originally applied only to the method of joining two pieces of wrought iron or steel by heating them until they became soft and hammering or pressing them together. This method is applicable only to the two metals mentioned, but it gives a perfect joint. This process is now called "forge welding" to distinguish it from another process that has been given a similar name.

This other method of joining metals, most accurately designated as "fusion welding," has during the last few years become enormously important both for fabrication and repair work. Fusion welding is performed by actually melting together the pieces to be joined by the application of a local intense heat so that only a small part of each piece is brought to the melting point. This has been used for lead for many years under the name of "lead burning." It is applicable to all metals.

Varieties of Fusion Welding

Fusion welding is generally divided into three classes according to the different sources of heat. The classes are: 1. Gas welding (oxy-acetylene or oxy-hydrogen). 2. Electric arc welding. 3. Thermit welding.

The field of thermit welding is limited on account of the fact that clumsy, heavy apparatus is necessary for its use. It is therefore used only on very large jobs or in places where a lot of building up with new metal is necessary. This leaves the rest of the field to gas welding and electric welding, and the field is broad indeed.

Both gas and electric arc welding adapt themselves to the use of portable and easily handled equipment. This makes it possible for welds to be made in positions and places where it would not be possible to fasten or join pieces of metal in any other way. They also permit of repair work and fabrication away from the shop. Gas welding has the advantage that it is somewhat more generally applicable and requires no protection for the operator other than a pair of goggles, but electric arc welding has the advantage of its ability to deposit metal on a vertical surface or even overhead.

The variety of applications of gas and electric arc welding is, of course, very great. In fact they can be used in almost every case where two pieces of metal are to be joined together. They are especially of value where the joint must be fluid tight. In addition to joining two already existing pieces of metal, a very important feature of gas and electric arc welding is their ability to build up or add metal to an existing piece of metal. In short, they constitute a new and enormously valuable tool that has in its few years of existence opened up countless possibilities in industrial fields. Its great value in the industrial chemical plant has been proved and its applications there are apparently unlimited.

All methods of fusion welding have the disadvantage that the weld is of cast metal and that the nearby parts of the joined pieces are overheated and thereby weakened. Fusion welding is merely the making of a casting of whatever metal is being welded. The conditions that produce sound castings are fairly well known. The melted metal must be protected from oxidation, it must not be overheated and it must be of the best composition. It is impossible to obtain these conditions in this process of welding. Even the best weld is only a casting made under rather poor conditions and consequently its ductility is very low. This can be made up for to a certain degree by making the amount of metal at the weld much greater than at other parts of the pieces to be joined—that is, by making the cross-section greater at the point of low ductility. It cannot be expected that the same results, either physical or chemical, will be obtained in the welded piece as in the forged piece. When heat-treated pieces are being joined by fusion welding, the heat-treatment is, of course, destroyed for some distance from the weld by the high temperature of the operation. Consequently good judgment should be used in applying any of the methods of fusion welding. An authority on fusion welding has stated the following problems that are still to be solved:

Problems Still to Be Solved

1. Production of sound cast metal by eliminating seams, layers, holes and, as far as possible, oxidation.
2. Improvement of properties of cast metal by choice of suitable composition, as heat-treating is usually impossible.
3. Allowance for unavoidable weld stresses and removal, when possible, by annealing.

This last is an important one and if kept in mind many otherwise poor jobs can be done well. Whenever it is possbile to anneal a fusion welded joint, this should be done.

The present limitations of fusion welding that have been pointed out do not prevent its great and increasing use. They simply indicate the important point being kept in mind in further development of this process.

Use of Asphalt Grows in 1923

The asphalt industry covers a variety of products, including petroleum asphalt, various native asphalts, rock asphalts, road oils and fluxes. During 1922, the United States Geological Survey reports, the total amount of asphaltic material consumed in the United States was 2,446,024 short tons, in addition to which approximately 60,000 tons was exported. Of the total amount 2,047,308 tons was recovered directly from petroleum, 122,929 tons consisted of imported lake asphalt and 298,047 tons was domestic rock asphalt. As the last-mentioned product averages less than 10 per cent of asphalt proper, the amount of actual asphalt therein represented is about 30,000. The importation of native asphalt, mainly from Trinidad and Venezuela, has, during the past 10 years, averaged approximately 130,000 tons annually, and it is probable that even less than that amount has been imported during 1923.

The asphalt industry, says J. E. Pennybacker, manager of the Asphalt Association, depends for its principal market upon two construction industries, paving and roofing. The great bulk of this industry is represented by petroleum asphalt, approximately 50 per cent of which was used for paving and road treatment and 38 per cent for roofing and waterproofing during 1922. The complete paving tonnage for 1923 is not yet available, but figures already compiled indicate an increase over 1922 of 20 per cent.

Fractionation of Completely Miscible Liquids

Taking a Mixture of Ethyl Alcohol and Water as Typical, the Mechanism of Separation Is Explained in a Practical, Easily Understandable Manner

BY ERNEST J. WINTER
Consulting Engineer, New York City

DISTILLATION is one of the oldest processes of chemical engineering, the art (distillation of potable alcohols) having had its beginning in the second or third century A.D. At present it is employed in a large number of chemical industries, where separation and purification of a mixture of volatile liquids is desired. In such cases it is usually the only means available to accomplish the desired separation. The following partial list of manufactures employing this process shows the great importance of fractional and simple distillation:

Volatile and mineral acids.
Ammonia.
Kerosene, gasoline, petroleum-ether, etc.
Benzols, terpenes, etc.
Oxygen, nitrogen, argon, etc.
Methyl, ethyl and higher alcohols.
Potable alcohols.
Ethers, esters, chloroform.
Ketones, (acetone, etc.).
Essential and other vegetable oils.
Aniline, aniline oils.
Glycerine.

Separation of a mixture of liquids by fractional distillation is based on the difference in volatilities of the various constituents. For example, at atmospheric pressure pure ethyl alcohol boils at 78.4 deg. C., while pure water boils at 100 deg. C. The two are miscible in all proportions, and the boiling point of a mixture of ethyl alcohol and water will be between 78.4 and 100 deg. C., the boiling points of the pure constituents. The higher the proportions of ethyl alcohol (the higher the proof) the nearer will the boiling point of the mixture approximate 78.4 deg. C., the boiling point of absolute (chemically pure) alcohol. In other words, the higher the proof the lower the boiling point.

Experiments show, for example, that a mixture of 50 per cent pure ethyl alcohol and 50 per cent pure water, by volume, boils at 82.81 deg. C. The vapors formed during this evaporation, however, will not consist of 50 per cent of alcohol and 50 per cent of water, but they will contain 74.95 per cent of alcohol and only 25.05 per cent of water. The vapors will be richer in the more volatile constituent, ethyl alcohol in this case. As a general rule, vapors formed from a mixture of miscible liquids are richer in the more volatile constituent than the original liquid.

DISTILLATION

If you are at all uncertain as to the mechanism of fractional distillation, study this article and see if Mr. Winter's lucid presentation of fundamental principles does not clear up your difficulties.

A UNIT PROCESS OF CHEMICAL ENGINEERING

The following figures show the composition of the vapors, in per cent, by volume, of ethyl alcohol from various strengths of liquids. (Sorel's table):

C_2H_5OH in Liquid Per Cent	C_2H_5OH in Vapors Per Cent
5	35.75
10	51.00
20	66.20
30	69.26
40	71.95
50	74.95
60	78.17
70	81.85
80	86.49
90	91.80
100	100.00

It is evident that when a mixture of liquids is gradually diminished in volume through vaporization, the liquid residue becomes poorer and poorer in alcohol, because larger proportions of alcohol leave with the vapors than were present in the liquid originally.

The reverse process is just as true. If vapors containing 69.26 per cent of alcohol condense, the first drop of liquid will contain 30 per cent of alcohol. Consequently the residual vapors become richer and richer in alcohol, because the proportions of alcohol in the condensate are smaller than in the original vapors.

Finally, we must state a very important law of physical chemistry—namely, that vapors in intimate contact with a liquid have always a composition which is directly related to the composition of the liquid. Referring to the above table, we may note that vapors containing 69.26 per cent of alcohol cannot be in intimate contact with a liquid which contains more or less than 30 per cent of alcohol. If the liquid contains more, for example, it will give up some of this alcohol to the vapors and some of the water in the vapors will condense until equilibrium is established between the liquid and the vapor phases.

Fig. 1 shows graphically the above table. It shows the percentage of liquid which may co-exist with a definite strength of alcoholic vapors. The vapors may originate from liquids that are poor in alcohol and then come in contact with a liquid which is too rich to co-exist with these vapors. There will be an immediate exchange of constituents, if only the contact is sufficiently intimate. The vapors become richer in alcohol and the liquid becomes poorer, and an equilibrium is established.

Fig. 2 shows a batch still, the method of operation of which will be explained now from the foregoing considerations. A continuous still differs somewhat in design, but the principle of operation is the same. The kettle is a large horizontal or upright cylindrical vessel, provided with a steam heating coil 1, the steam inlet being regulated by valve 2, and the condensate discharged through trap 3. The charge, consisting of a liquid mixture, is introduced into the kettle and brought to boil. The vapors pass through tube 4 into the column. The column consists of an upright cylindrical shell provided with horizontal plates 5, the number of which depends upon the work intended to be performed.

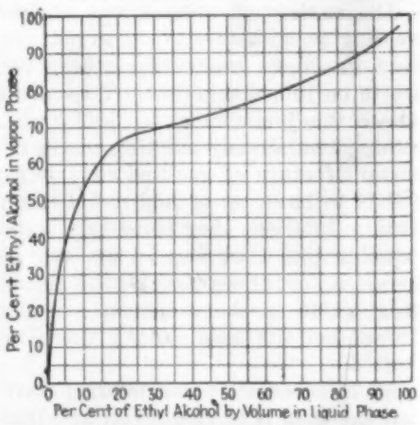


Fig. 1—Equilibrium Concentrations of Liquid and Vapor Phases, Ethyl Alcohol Under Atmospheric Pressure

Each plate is usually provided with several vapor pipes 7, the vapor pipes being covered with caps 6, although other construction is resorted to occasionally.

The vapors entering through 4 must pass through vapor pipes 7 and under the edges of caps 6, to the vapor pipes on the plate immediately above, etc., until the vapor outlet of the column 10 is reached. The vapors pass into a tubular condenser 11, which is water cooled and known as a dephlegmator (separator or goose), where part of the vapors are condensed. This portion of the vapors is returned to one of the top plates of the column through tube 14. The remainder of the vapors passes through tube 13 to cooler 12, where it is entirely condensed and discharged to tail-box 17.

The condensate returning from dephlegmator 11 through tube 14 to the column will pass from plate to plate, through overflow pipes 8, until it reaches the bottom of the column, and thence through pipe 9 returns to the kettle. The overflow pipes 8 extend above the plates 5 sufficiently to maintain a liquid level on the plates, which will force the vapors, when passing under caps 6, to bubble through a shallow layer of this liquid seal. It will be seen therefrom that the vapors come into very intimate contact with the liquid seals of the plates, but the vapors pass upward, while the liquid is overflowing from plate to plate downward to the kettle.

Now let us assume that our original charge consisted of 50 per cent alcohol and 50 per cent water, by volume. When this mixture is brought to boil, the first vapors will consist of nearly 75 per cent of alcohol. If the column is cold, these vapors may condense and gradually fill the plates as far as the overflow weirs. At any rate, the vapors arriving in dephlegmator 11 will be partly condensed and return to the column to form the liquid seals on the plates, the excess overflowing and returning to the kettle. The first drop of liquid condensing from the vapors will contain only 50 per cent of alcohol, which is the same as the kettle charge. However, the residual vapors become stronger, as explained above, because the liquids condensing out of them are not as rich in alcohol as the vapors themselves.

Further condensation will result in richer liquids than 50 per cent, because they originate from vapors richer than 75 per cent. Suppose they originate from vapors containing 81.85 per cent of alcohol; in this case the liquid must contain 70 per cent of alcohol. This liquid of higher concentration will drop from plate to plate and come in contact with vapors from the kettle which are not rich enough to be in equilibrium with such a rich liquid. The result is exchange of constituents and enrichment of vapors at the expense of the liquid. The condensate is richest in the dephlegmator, it becomes poorer and poorer in alcohol as it drops from plate to plate; while the vapors are poorest in alcohol where they enter the column, and become more and more concentrated as they pass upward through the plates, enriching at the expense of the refluxing liquid.

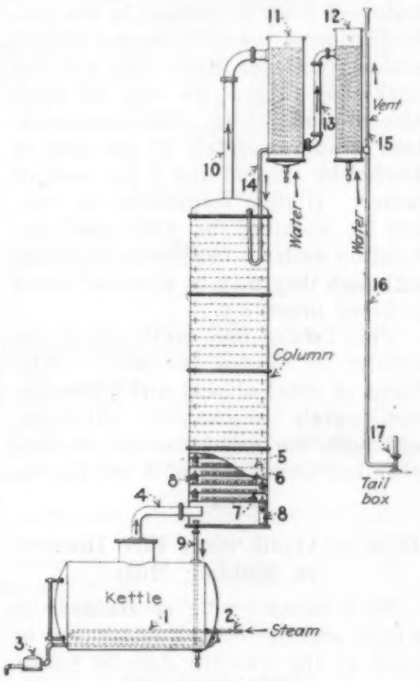


Fig. 2—Batch Still

It stands to reason that the liquid which eventually returns through tube 9 into the kettle cannot be poorer in alcohol than 50 per cent, because the vapors leaving the kettle are 75 per cent and cannot take up alcohol from a liquid poorer than 50 per cent. In fact, the liquid returning to the kettle cannot contain as little as 50 per cent, unless we assume 100 per cent efficiency. The intimacy of the contact between the liquid and vapor phases, however, is never perfect, and the number of plates is limited; an efficiency of 92 per cent is not unusual, but should not be counted upon.

Supposing 100 parts by volume of vapors pass through tube 4 into the column. These vapors will contain 75 parts of alcohol and 25 parts of water. Now let us assume that the distillate which leaves through tail-box 17 must contain 90 per cent of alcohol by volume. If all the alcohol passing through tube 4 could be obtained in tail-box 17 at 90 per cent concentration, we should obtain 83⅓ volumes of the 100 as "flow" in 17. In this case, however, it would be necessary to return the difference—that is, 16⅔ volumes of pure water—through tube 9 into the kettle. We have explained above that this is not possible, that the liquid returning through tube 9 must contain at least 50 per cent of alcohol; consequently the best that can be hoped for, and we repeat it here, that this presupposes 100 per cent efficiency, would be a division of the original 100 volumes of vapors (passing from kettle through tube 4 into the column) into two portions: One containing 90 per cent of alcohol passing to tail-box 17, and one containing 50 per cent of alcohol returning through tube 9 into the kettle. Figuring on these proportions, we find the original 100 volumes will be divided into two parts as follows: 62.5 volumes containing 56.25 volumes (90 per cent) of alcohol, will leave through tail-box 17 as finished product, and 37.5 volumes containing 18.75 volumes of alcohol (50 per cent) will return through tube 9. In actual work, 80 to 90 per cent of the above "flow" of finished goods may be counted upon, the remainder returning to the kettle as "reflux." The two volumes—namely, 62.5 leaving through tail-box 17 and 37.5 returning through tube 9—would not contain the same proportions of alcohol and water. Consequently the latent heats of vaporization per volume, specific heats, boiling points, etc., will be different. The heat that must be abstracted from the vapors in order to obtain a liquid for the return through tube 9 (reflux) is abstracted in dephlegmator 11, while the heat that must be abstracted to obtain the "flow" in tail-box 17 in liquid form must be abstracted in cooler 12. The relative number of thermal units can be readily calculated from the latent heat of vaporization of water and alcohol, or may be obtained direct from tables.

It is to be noted in this connection, however, that the heat that is to be furnished and subsequently abstracted during vaporization and condensation contains, in this particular case, another item, which is known as the heat of solution. Considerable heat is developed during

the mixture of alcohol and water. In the above case 1 kg. of mixture containing 50 per cent of alcohol has a heat of solution of 8.41 calories. This is the heat that was developed during mixture and that has to be furnished over and above the heat of vaporization during separation of the two constituents.

Fig. 3 shows a continuous still. The kettle is omitted here and the liquid mixture, known as "feed" is introduced some place midway on the column as shown. The heat is furnished at the bottom of the column, and care must be taken that the residue leaving the column should not contain any more alcohol. The method of operation is the same as before, and the method of calculation will remain likewise the same. Below the feed plate the liquid seals on the plates become gradually weaker and weaker and drop below the concentration of the feed, because they come in contact with pure water vapors from the bottom. Gradually they are exhausted of the more volatile constituent, ethyl alcohol in this particular case, and the liquid which passes out of the column through the atmospheric seal consists of the higher boiling constituent only, water in this particular case.

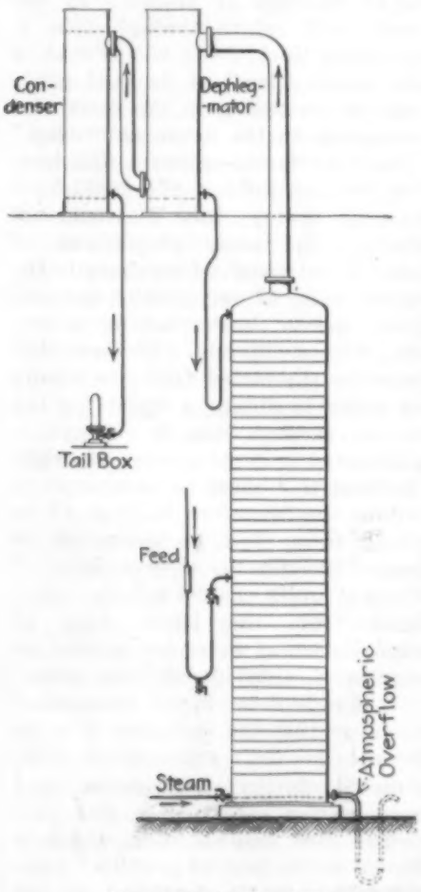


Fig. 3—Continuous Still

Conditions are radically different when the mixture consists of liquids not miscible in all proportions. Then the boiling point of the mixture is not necessarily between the boiling points of the constituents. These distillation processes require a special treatment.

The separation of more than two constituents is just as simple as the separation of two completely miscible liquids as long as all liquids are miscible in one another in all proportions. However, there are exceptions to this general rule, and even in the above-named example — namely, in the separation of ethyl alcohol and water—a limit is reached in the concentration of the ethyl alcohol beyond which fractional distillation will not enable us to go. In case of ethyl alcohol and water, this concentration is approximately 97 per cent of alcohol by volume and 3 per cent of water. Higher concentrations cannot be obtained by fractional distillation under atmospheric pressure, although they may be obtained under reduced pressures.

This fact is due, no doubt, to the affinity of alcohol for water; mixtures of ethyl alcohol and water are not purely mechanical mixtures, although the exact nature of their chemical "combination" is not known.

How to Avoid Static Fire Hazards in Rubber Mills

In a paper on "Fire Hazards in Churn and Spreader Rooms" that he read at the Twelfth Annual Safety Congress of the National Safety Council, Buffalo, Oct. 1 to 5, 1923, William D. Milne, of the Underwriters Bureau of New England, Boston, presented some valuable data on the elimination of fires due to static electricity, probably the most baffling cause of fire. Charges of "static" are built up under certain conditions upon belts, on moving surfaces of cloth, on the bodies or clothing of workmen, in vapor clouds, and perhaps sometimes in flowing solvents at nozzles or jets. Discharges of "static" electricity occur between bodies having different electric potentials, and if the proper air-vapor mixture is present fire may readily follow. The problem of avoiding fires from this cause resolves itself into the question as to how all the bodies in the danger area may be maintained at the same potential.

The difference in potential between the cloth being treated and the machine may be eliminated in part by connecting the knife of the spreader, the steam pipes of the table and the frame of the machine to a secure and permanent ground. Unless the ground is well done and well maintained, the protection afforded will not be satisfactory and further measures are frequently necessary. Experiments show that static charges exist on the cloth as it is unrolled before the spreader, are largely discharged silently by a properly grounded knife, but build up anew immediately after the cloth passes the knife and rapid evaporation of the solvent occurs. These charges may continue on the cloth and be rolled up with it so that when it is unrolled for a secondary coating they may cause considerable trouble. These charges are very difficult to avoid, and thorough grounding of the steam table does not fully effect their dissipation. Where such charges give recurrent trouble, it may be necessary to resort to special humidification to drain them away.

A high relative humidity apparently allows "static" charges to drain off silently, 40 to 45 per cent relative humidity giving a safe atmosphere. Artificial humidification can be used to improve conditions where trouble from static is experienced. It has been found oftentimes that the use of constant steam jets at spreaders has prevented the flash fires to which these machines are subject, but general humidification, arranged to operate automatically when required, may be the most satisfactory solution in many cases.

Static charges are frequently developed on the persons of the workmen, some men apparently being more subject to this phenomenon than others. Good practice in spreader rooms provides for the common grounding of men, machines and material tubs, so that all may have the same potential. This is achieved by providing grounded metal floor coverings in front of the machines and under tubs, and requiring workmen to wear brass or copper pegged shoes.

A frequent cause of fire is the discharge due to difference in potential between discharge outlets and containers into which solvents are received. It is important that the discharge device and the container be grounded together. Serious troubles have occurred in connection with scale tanks where properly interconnected grounds were not provided.

Equipment News

From Maker and User

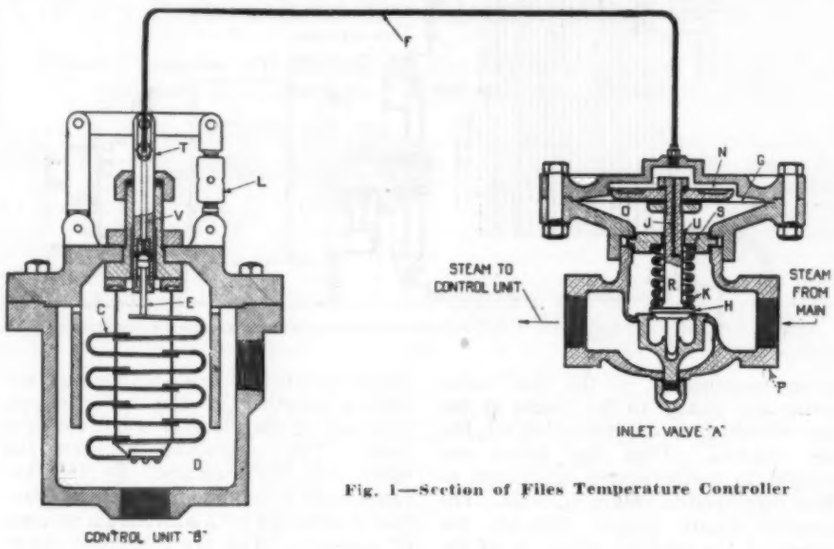


Fig. 1—Section of Files Temperature Controller

Temperature-Controlling Device of Rugged Design

Controller Recently Placed on the Market Operates Without Such Auxiliary Elements as Compressed Air or Volatile Liquids

A NEW patented temperature-controlling device is being introduced by the Files Temperature Control Co., Bridgeport, Conn. This device has been tried out in actual service by several large industrial companies. The results obtained were, as reported to the makers, in each case satisfactory. The device is recommended for use with such equipment as calender rolls, steam kettles, steam tables, vulcanizers and similar apparatus.

Referring to Fig. 1, the two parts of the device, inlet valve and control unit, will be seen. The opening and closing of inlet valve *A* is actuated by the flow or interruption of steam through governor pipe *F*. Pilot valve *E* is operated by the thermostat *C*.

When the temperature of the fluid surrounding thermostat *C* reaches the degree to be maintained, the expansion of the couple closes pilot valve *E*, preventing the escape of steam from the upper diaphragm chamber *N* through governor pipe *F*. Steam flowing through port *J* in inlet valve stem *R* builds up initial pressure in chamber *N*, permitting tension of spring *K* to close valve *H* against the flow of steam from its source.

The steam passing through orifice *U* between stem *R* and guide hub *S* maintains initial pressure in chamber *O* under the diaphragm, balancing same. When the temperature of the fluid which the thermostat *C* is controlling starts to fall below the required temperature, the couple *C* contracts, permitting the opening of pilot valve *E*, followed by steam flowing from chamber *N*.

The diaphragm *G* having initial pressure on its under side *O* maintained by the flow of steam through orifice *U* being properly proportioned, the difference in pressure between the upper and lower faces of the diaphragm caused by steam flowing from chamber *N* lifts the diaphragm, compressing spring *K*, causing valve *H* to open, and steam flows through inlet valve to the service system. The working temperature may be changed manually by the operation of sleeve nut *L*, which is connected to post *T*.

The body *P* of the inlet valve is made of bronze and is tested to a working pressure of 200 lb. The diaphragm consists of two pieces of phosphor bronze diaphragm metal and is guarded against rupture. The flanges are fine-grained cast iron and are ground to a joint so that no gaskets are required. The valve disk and stem are composed of bronze as is the guide hub *S*. The control unit, consisting of thermostatic chamber, thermostat, pilot valve, operating lever, etc., is carefully made and machined. The thermostat *C* is a thermocouple consisting of a high and low expansion metal laminated together. This metal is guaranteed to withstand a temperature of 350 deg. F. without permanent set. With the exception of thermostatic chamber *D* all parts are made of bronze.

The following claims are made by the manufacturer for this controller:

1. Uniform control of temperature within 1 deg. F. above or below the desired temperature.

2. No auxiliary elements such as compressed air, volatile liquids, electricity or clockwork are required for operation. The flow of the fluid through the inlet valve controls the apparatus.

3. Thermostat is constructed of solid metal tested to 350 deg. F. without permanent set.

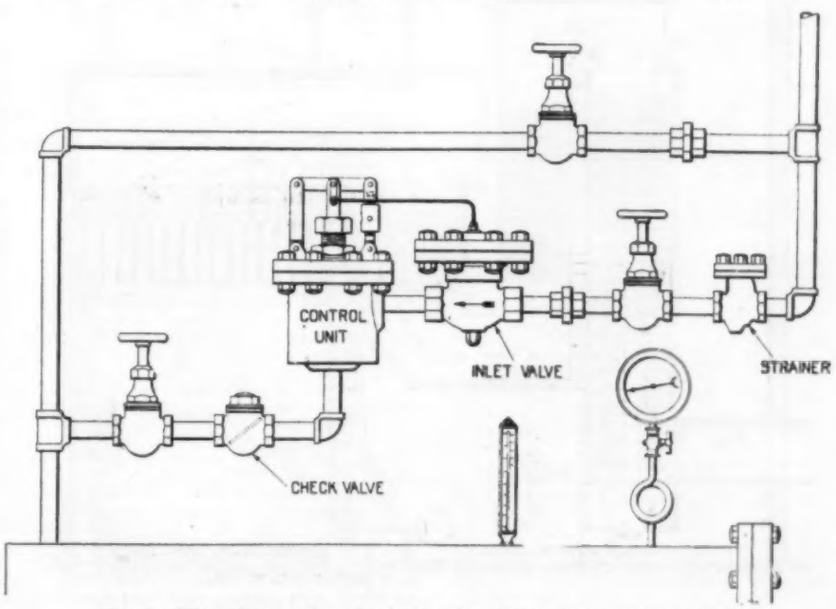


Fig. 2—Files Temperature Controller Applied to Rubber Vulcanizer

4. Working temperature can be readily and easily changed by turning sleeve nut in direction indicated.

5. Rugged construction insures long life and withstands rough usage.

6. All parts are easily accessible for inspection and cleaning.

7. Thermostat may be placed entirely outside the apparatus to be controlled, and the inlet valve may be placed at any reasonable distance from the thermostat.

Emmet Mercury Boiler

Design Features of the Equipment as Installed at the Plant of the Hartford Electric Light Co.

The editorial columns of *Chem. & Met.* recently carried information as to the operation and efficiency of the Emmet type mercury-steam boiler (Dec. 31, vol. 29, pp. 1174-5). For the benefit of those interested in the construction of this unit we give the information below.

Figs. 1 and 2 show sections through the equipment as installed at Hartford. On these figures the temperatures (approximate) of the various steps have been indicated. It will be noticed that the turbine and mercury condenser (steam boiler) is above the mercury boiler, so that the condensed mercury returns by gravity and thus eliminates the feed pump. The only pump in the system is a vacuum pump of the water-seal type which sucks through a canton-flannel screen. Every joint in the system is welded so as to avoid any possible leakage of air or mercury vapor.

The boiler is oil fired and the flue gases, after passing up through the mercury boiler, are led to a mercury heater or economizer, thence over the steam superheater to the feed-water heater and finally to the stack, at the base of which is an induced-draft fan (not shown). Thus the gases are brought to temperatures equivalent to those employed in steam systems. The mercury vapor passes through the runner of the turbine, which is of the single-stage impulse type and is expanded to a pressure corresponding to 29 in. of vacuum. From the condenser the mercury liquid flows into a sump and drains back into the boiler. The mercury boiler is of the vertical type, cylindrical in form, and has a single tube sheet into which the tubes are expanded and then welded; the lower ends are free to expand. The lower two-thirds of each tube is hexagonal in shape with the sides slightly curved. These curved sides of adjacent tubes are placed tangent to one another and are welded together at the lower edges, thus taking the place of a bottom tube sheet. The interstices between the tubes hold the mercury. By this arrangement a maximum of heating surface is obtained with a minimum amount of mercury. The present boiler holds about 30,000 lb. of mercury and is designed to evaporate 230,000 lb. of mercury per hour. At this rate the turbine would develop 1,900 kw. and deliver about 28,000 lb. of steam per hour at 200 lb. and 100 deg. superheat; although it is understood that the Hartford installation has not been driven to this capacity, as it has been thought expedient to run at reduced load in order that experience with continued operation may be had.

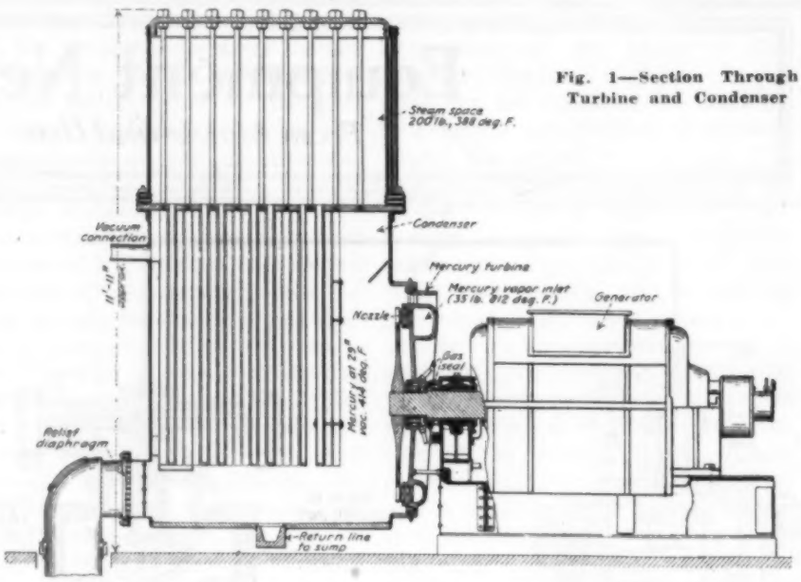


Fig. 1—Section Through Turbine and Condenser

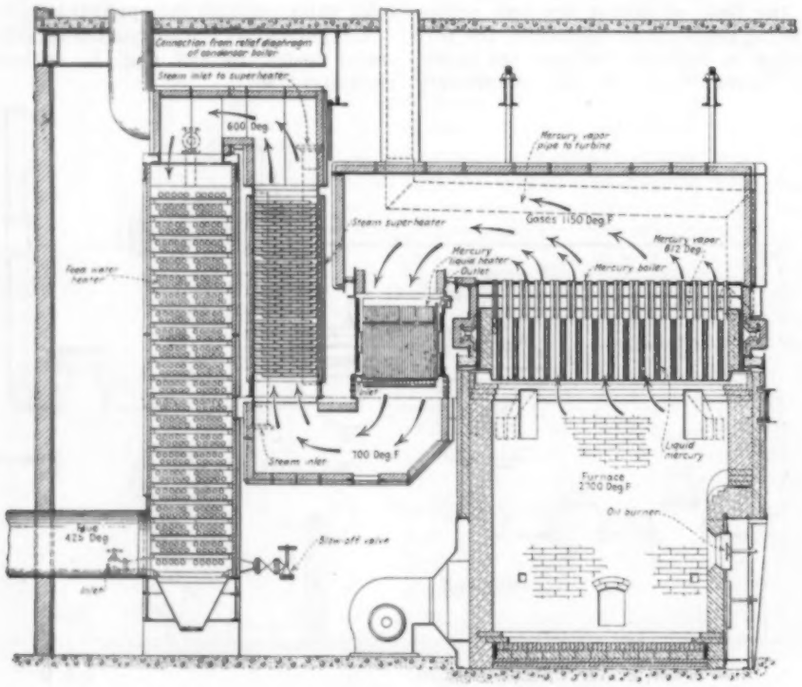


Fig. 2—Section Through Boiler, Heater and Superheater

In general design the mercury turbine is not unlike a steam turbine except that the blading is of tool steel to resist the cutting action of the mercury, and the glands are sealed with illuminating gas. The turbine is bolted to the side of the condenser and then welded. When it is found necessary to shut down the unit, the illuminating gas is turned into the system, and thus prevents the infiltration of air that might cause oxidization of the mercury.

Like the mercury boiler the condenser consists of a vertical cylindrical shell with the tubes rolled and welded into a single upper tube sheet. The tubes are closed at their lower ends, but are not attached to one another. In this way provision is made for free expansion and contraction.

The mercury sump is also under a gas seal and is provided with an ingenious form of strainer consisting of slanting baffles which project into the liquid and carry a wire mesh on their under sides. Any oxide that may be floating on the surface of the mercury is thus caught by the baffles.

As previously stated, the Hartford installation, while successful, is merely a step in the development.

Review of Recent Patents

Double-Superphosphate Production Simplified by Eliminating Den

Dilute Phosphoric Acid May Be Used if Reaction and Drying Operation Are Conducted Simultaneously in a Direct Heat Drier

SEVERAL of the usual steps in manufacturing double-superphosphate are avoided in a process proposed by Herbert H. Meyers, of Pittsburgh, Pa., in Patent 1,475,959, granted Dec. 4, 1923, and assigned to Armour Fertilizer Works.

Double-superphosphate, the usual designation of the material produced by the treatment of phosphate rock with phosphoric acid, ordinarily contains between 40 and 50 per cent P_2O_5, whereas acid phosphate produced by the acidulation of phosphate rock contains between 1 and 20 per cent P_2O_5. In making phosphoric acid by treating phosphate rock with sulphuric acid, the acid must be dilute, as the result is not satisfactory with strong acid. As the resulting phosphoric acid contains not more than 30 per cent orthophosphoric acid, H_3PO_4, it must be concentrated until the H_3PO_4 content is practically doubled before it can be mixed with phosphate rock to produce double-superphosphate. Dens are used as in acid phosphate practice, but the product contains too much moisture and must be dried before disintegrating.

In outline, the old process consists of the following steps:

1. Preparation of dilute H_3PO_4.
2. Concentration of the H_3PO_4.
3. Mixing acid and rock.
4. Emptying the den.
5. Drying the double-superphosphate.
6. Disintegrating the product.

In contrast with this is Mr. Meyer's new method, which involves only four steps:

1. Preparation of dilute H_3PO_4.
2. Mixing acid and rock to form slurry.
3. Heating the slurry to accelerate simultaneously the chemical reaction and dry the double-superphosphate to a solid product.
4. Disintegrating the product.

One method of operation is to produce the dilute phosphoric acid by the well-known Dorr system of agitation and continuous decantation — for example, such system may consist of two or three agitators and about six thickeners.

Into the first of such three agitators there is introduced continuously ground phosphate rock, sulphuric acid of a strength from about 50 to 60 deg Bé., and weak phosphoric acid liquor from thickener No. 2.

The ratio of rock to 50 deg. Bé. acid used, by weight, would be approximately 1 part of rock to 1.15 parts of 50 deg Bé. acid.

The slurry so formed passes through the agitators and into the first thickener, the strong clear liquor from which runs continuously to another or single agitator.

The settled sludge is pumped up through the series of six thickeners and is washed by counter-current decantation, the exhausted sludge from the last thickener being carried to the waste.

American Patents Issued December 25, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate out readers interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,478,375—Electric Furnace. Morris H. Bennett, Waterbury, Conn., assignor to Scovill Manufacturing Co.

1,478,396 — Tank-Room Structure. Henry D. Pownall, Canton, Ohio.

1,478,410 — Sole-Heated Coke Oven. Theodor von Bauer, Burgel, Turingen, Germany, and Bernhard Zwillinger, New York, N. Y.; said von Bauer assignor to said Zwillinger, Klara Zwillinger administratrix of said Bernhard Zwillinger, deceased.

1,478,413—Apparatus for and Method of Cracking Hydrocarbons. Frank E. Wellman, Kansas City, Kan., assignor to Kansas City Gasoline Co., Kansas City.

1,478,418. — Bagasse and Liquid-Fuel Furnace. Roberto Almagro, Habana, Cuba.

1,478,438—Process of Mixing and Delivering Oil and Aluminum Chloride. George H. King, Port Arthur, Tex., assignor to Gulf Refining Co., Pittsburgh, Pa.

1,478,439 — Blast-Furnace Construction. Edmund B. Kirby, New York, N. Y.

1,478,444—Distilling Oil With Aluminum Chloride. Almer McDuffie McAfee, Port Arthur, Tex., assignor to Gulf Refining Co., Pittsburgh, Pa.

1,478,478 — Pulverizing Apparatus. Otto A. Kreutzberg, Lake Bluff, Ill.

1,478,479—Process and Apparatus for Utilizing Liquefied Gases. Walter Lachman, Dresden, Germany.

1,478,498 — Method of Manufacturing Alkyl Esters. Herman F. Willkie, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.

1,478,526—Process and Apparatus for Removing a Vaporizable Substance from Powdered Material. Oliver Edward Merrell, Syracuse, N. Y., assignor to Merrell-Soule Co., Syracuse.

1,478,543 — Gas-Purifying Apparatus. Eugene H. Bird, Hillside, N. J., assignor to Koppers Co., Pittsburgh, Pa.

1,478,549-50—Catalytic Apparatus for the Synthesis of Ammonia. Luigi Casale, Rome, Italy, assignor, by direct and mesne assignments, to Casale Ammonia Co., Lugano, Switzerland.

1,478,554—Glass Manufacture. Robert M. Corl, Maumee, Ohio, assignor, by mesne assignments, to Erie Glass Co., Toledo, Ohio.

1,478,559—Process of Treating Hydrocarbons. Gustav Egloff, New York, N. Y.

1,478,570 — Coke Oven. Thomas G. Kus, Chicago, Ill., assignor, by mesne assignments, to Chicago Trust Co., trustee, Chicago.

1,478,580—Combined High and Low Level Valve and Depth Indicator. Louis Rieske, Mayfield, Ohio, assignor, by direct and mesne assignments, to Sadie M. Moorhouse, Cleveland, Ohio.

1,478,588—Explosive. Ernest M. Symmes, Wilmington, Del., assignor to Hercules Powder Co., Wilmington, Del.

1,478,614—Process for Digesting Wood Pulp. Einar Morterud, Torderod, near Moss, Norway, assignor to A/S Cellulosepatenter, Christiania, Norway.

1,478,660—Centrifugal Separator. Gerard Charles Barnes and James Roberts Morgan, Coogee, New South Wales, Australia.

1,478,690—Process of Producing Terpenic Alcohols. Roland L. Andreau, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.

1,478,750—Process of and Apparatus for Condensation. Karl P. McElroy, Washington, D. C., assignor to Gulf Refining Co., Pittsburgh, Pa.

1,478,798 — Apparatus for Electrical Treatment of Gases. Arthur A. Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles.

1,478,810—Furnace. Frederick H. Wolkenhauer, Bensenville, Ill.

1,478,842 — Method and Means for Working Clay. Raleigh H. Staley, Springfield, Ill., assignor to Chambers Brothers Co.

1,478,863 — Process and Machine for Refrigeration. William Stewart, Portland, Me.

1,478,864—Process of Producing Coke. Walter E. Trent, Washington, D. C., assignor to Trent Process Corporation, Washington.

1,478,879—Sectional Dehydrator. William B. Nichols, Haddon Heights, N. J., assignor of one-half to Thomas E. Benson, Audubon, N. J.

1,478,889—Process of Purifying Gases for Ammonia Synthesis. Ivar Walfrid Cederberg, Berlin-Steglitz, Germany, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway.

1,478,926 — Manufacture of Artificial Silk From Acetyl Cellulose. Walter James Stevenson, London, England.

1,478,943 — Manufacture of Casein Glue. Edward Leonard Dance, Hamilton, Auckland, New Zealand, assignor to New Zealand Co-Operative Dairy Co., Ltd., Hamilton.

1,478,985-7—Artificial or Synthetic Charcoal and Process of Producing the Same. Jacque Cyrus Morrell, New York, N. Y.

1,478,990—Salt Manufacture. Charles L. Weil, Port Huron, Mich.; Ella S. Weil, special administratrix of said Charles H. Weil, deceased.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

The strong liquor from thickener No. 1 will contain possibly as much as 20 per cent P_2O_5 by weight, and to it, in such other agitator into which it is delivered as mentioned above, is added continuously ground phosphate rock in the approximate ratio of 1 lb. of rock per pound of P_2O_5 content of the liquor.

The slurry so formed in the agitator runs continuously into an inclined, rotary, direct-heat, cylindrical drier, and is passed therethrough as rapidly as is compatible with the desired condition of the product, which should be sufficiently dry for immediate use as a constituent of a fertilizer mixture.

The speed of operation depends in large measure upon the rate of fuel consumption and the entire process is regulated so that the production will keep pace with the yield of phosphoric acid from the Dorr system.

The rotary, inclined, direct-heat drier is preferably operated so that the combustion gases move concurrently and in contact with the slurry, thus preventing overheating of the product.

Any source of fuel may be used for heating the drier and the latter is desirably provided with means for preventing the charge from sticking to or building up in it, and accordingly the drier is preferably provided with a drag-chain or scraper arms.

The discharged product from the drier is passed through any of the usual types of fertilizer disintegrators to insure uniform fineness, and it is then conveyed to storage.

Purification of Brine for Ammonia Soda Process

Addition of Barium Sulphide Removes Sulphates and Also Functions to Prevent Corrosion of Ammonia Soda Equipment

Benjamin T. Brooks, of Bayside, L. I., has developed an improved process for purifying brines, particularly those for use in the ammonia soda process. It is described in Patent 1,475,563, issued Nov. 27, 1923, and assigned to Mathieson Alkali Works.

Natural brines almost invariably contain salts of calcium and magnesium, mainly the sulphates and chlorides. In the purification of brine for the manufacture of pure table salt and other purposes, it is common practice to remove the calcium and magnesium by the addition of sodium carbonate, thus precipitating the calcium and magnesium as carbonates, which are removed by filtration or sedimentation. To the extent that gypsum and magnesium sulphate were originally present, sodium sulphate is formed and will remain in the solution. It is common practice to treat the solution with barium chloride, which removes the sulphate radical as insoluble barium sulphate, forming corresponding amounts of sodium chloride in solution, so that the solution then contains practically nothing but sodium chloride.

In the ammonia soda process, it is distinctly advantageous not only to free the brine from calcium and magnesium and from the sulphate radical but also to add a small amount of ammonium sulphide to the brine to prevent corrosion of the iron apparatus thereby. This corrosion is due largely to the ammonium chloride formed in the process from the interaction of the sodium chloride, carbon dioxide and ammonia.

Instead of producing separately barium chloride and ammonium fluoride, Dr. Brooks proposes to combine the essential functions of the two treatments by the use of barium sulphide. Precipitation of sulphate is satisfactory and the resulting sodium sulphide functions in an entirely satisfactory manner in preventing corrosion. Calcium and magnesium may be removed either prior to or subsequent to the barium sulphide treatment. The barium sulphate precipitate may be marketed if pure enough or it may be reduced to barium sulphide again, thus making the purification cyclical in character.

As a typical example, 450,000 gal. of natural brine, containing about 9.4 tons of calcium sulphate, is first treated with sodium carbonate in the manner above described, and thereby freed from calcium by precipitation of calcium carbonate, leaving sodium sulphate in solution. The brine is then treated with about 11.6 tons of barium sulphide, which is preferably added in the form of a hot concentrated solution containing about 24 per cent barium sulphide. The barium sulphide reacts with the sodium sulphate and forms about 16 tons of barium sulphate precipitate. This precipitation of the barium sulphate can advantageously be carried out in a series of settling tanks into which the brine freed from calcium and magnesium is fed continuously and into the first of which the barium sulphide solution is added in a regulated flow. The clear brine, containing the protective sodium sulphide, will thus be obtained, freed from sulphates and well adapted for use in the ammonia soda process. It can then be passed to the absorption towers and treated with ammonia and carbon dioxide in much the usual way.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

How Shall We Measure the Volatility of Motor Fuels?

To the Editor of Chem. & Met.:

SIR—A recent article in your journal (vol. 29, p. 970) by Dr. W. A. Gruse, of the Mellon Institute, proposes a weighted index number as a method of expressing the effective volatility of motor fuels. The writer is thoroughly in sympathy with the increasing tendency on the part of petroleum technologists to use something else besides the end point as a measure of the effective volatility of motor fuels, but the proposed weighted index number of Dr. Gruse appears to be open to two serious objections as compared with the use of the 85 per cent point proposed by the writer and D. P. Barnard about 2 years ago.

It must, of course, be admitted at the outset that the effective volatility of a motor fuel, from the standpoint of completeness of vaporization, effective distribution in the manifold and the prevention of crank case dilution, is not determined by any single point on the Engler distillation curve, but that it does bear a close relationship to the dew point, or initial condensation temperature, measured by any suitable method. Theoretically, of course, this dew point must be a function of an integration of the upper portion of the distillation curve (though it is not appreciably affected by the lower portion thereof). Such an integration, or the use of a weighted index number, would be rather complicated and for this reason the use of the end point had become customary as a measure of the effective volatility for distribution, etc.

However, by comparing the results on thirteen different fuels on which the dew points had been determined, the writer showed conclusively in several publications that the 85 per cent point bears a much closer relation to the dew point than does the end point and, indeed, that the 85 per cent point bears a closer relationship to the dew point "than any other single point on the distillation curve." While it was admitted that this relationship is not entirely accurate, it certainly seems to be far preferable to the use of the end point, and any other more complicated system would probably not come into popular use. The 85 per cent point (or the 90 per cent point, which is nearly as good) has a definite, concrete significance to anyone familiar with the distillation of gasoline, whereas an arbitrary index number has no such significance.

It is, of course, not surprising that by choosing arbitrarily six different points on the distillation curve, the dew point results on a given set of gasolines could be brought into closer agreement with an index number than with any single point on the distillation curve, because this method amounts to using an equation with six unknowns to fit a given set of data. Even with this advantage, however, the agreement between the observed dew points and those calculated from the index number is not so very much better than when the 85 per cent point is used, the aver-

age deviation being 5.6 deg. for the 85 per cent point, as compared with 3.9 deg. for the weighted index number. This difference of 1.7 deg. is certainly not enough to outweigh the complications involved in the use of the index number, especially since the index number was arbitrarily selected to fit at least part of this group of gasolines and would probably not agree as well with another group taken at random.

The other and more serious objection to the proposed index number is that it tends to combine two entirely separate things—namely, the lower portion of the distillation curve, which determines the starting volatility, and the upper portion, which determines the volatility from the standpoint of distribution, dilution, etc. Trying to combine these two separate factors in an index number is like trying to combine the viscosity and flash point of a lubricating oil into a single index number which would indicate general quality. A material which was exceptionally good in one of the respects might be very poor in the other and yet give a good index number. In other words, the statement in the summary of Mr. Gruse's article that "a low index number expresses high volatility and indicates good starting and accelerating properties, with low oil-diluting tendencies," is not necessarily true. Only by separating the two properties of starting volatility and volatility from the standpoint of manifold distribution and crank case dilution can real progress be made in grading gasoline. The writer still feels that for practical purposes the best single measure of the starting volatility is the 25 per cent point and of the distribution volatility is the 85 per cent point.

ROBERT E. WILSON.
Research Laboratories,
Standard Oil Co. (Indiana),
Whiting, Ind.

Double Standards for Metals

To the Editor of Chem. & Met.:

SIR—Your editorial in the Dec. 10 issue concerning the "double-barreled" requirements for metals certainly is timely. I have been trying for a number of years in my work to induce manufacturers with whom I have been associated to eliminate a chemical requirement on steel and iron materials.

Steel and iron are engineering materials, used solely for their physical properties, and not used for any contents of any chemical elements they may contain.

A chemical analysis on a ferrous material should be classed absolutely as an indicator to the maker of the material that by such relative amounts of certain ingredients the subsequent treatment of the product will give certain desired physical properties. Our practice of wide ranges of allowable analysis on steels is an example of this fact. I further believe that relative ratios are more serviceable than exact quantities. For instance, in a silicon steel for magnetic purposes, the indicated analysis might be represented as the ratio of iron to silicon as 24 : 1, with all other ingredients under an allowable limit, based on the iron ratio. This same method of indicating chemical constitutents to the steel manufacturer could be used on other steel and iron products, tool steels, alloy steels and ordinary grades of steels. This would not mean that the steel maker would eliminate the use of chemical analyses on his products, but it would mean that this phase of the fabrication of the material is entirely in his hands and under his control, and what the purchaser of his products desires is service and performance of the material.

In this connection I wish to add that the buying manufacturers of steel products are too eager to pick up something new, in the hope that they may find a panacea for some manufacturing ills they may be having. I refer to the heralded products of molybdenum, vanadium and other alloying metals. As a matter of fact, we do not know enough about the more common steels that are available, and we have incompletely studied their performance and properties. Exhaust the old before the new becomes too much of a habit.

I am indeed hopeful that we may yet be enabled to get away from our "double-barreled" metal requirements.

Chicago, Ill. R. C. GOSROW.

Books Received

Hydraulics

HYDRAULICS FOR ENGINEERS AND ENGINEERING STUDENTS. By *F. C. Lea.* Fourth edition. 594 pages, 379 illustrations. Edward Arnold & Co., London. Longmans, Green & Co., New York. Price, $6.

Regarding the method of treatment adopted in this standard work on hydraulics, the author makes the following interesting statement: "It might have been shortened very considerably if the author had simply been content to give particular results which can be used to solve practical problems with a considerable degree of confidence. Such a procedure would have defeated the author's purpose of making the book not only immediately valuable to practicing engineers but also of being a real help to the serious student and to enable readers to appreciate the nature of the evidence upon which results are based, and in some measure also to trace the developments of an interesting subject through a century of real progress."

Accordingly, chemical engineers who desire to master the fundamental principles of hydraulics in order to make more intelligent application of the formulas which have been developed will find this work invaluable.

Coke as Fuel

COKE AND ITS USES: IN RELATION TO SMOKE PREVENTION AND FUEL ECONOMY. By *E. W. L. Nicol*, engineer and fuel expert to the London Coke Committee. 134 pages, illustrated. Ernest Benn, Ltd., London. Price, 19s. 6d.

This book, which is the outcome of many years' specialized experience in adapting coal-fired steam boilers and other heating apparatus to the use of coke, is designed to promote the use of coke as fuel for both domestic and industrial heating. Full and concise information is given on such fundamental factors as grading for special purposes, relative capacities and costs of coke in comparison with competing solid fuels, both for hand firing and mechanical stoking.

Lead and Its Compounds

LEAD. By *J. A. Smythe, Ph.D., D.Sc.* 343 pages, illustrated. Longmans, Green & Co., New York. Price, $5.25.

This volume of the series of Monographs on Industrial Chemistry, edited by Sir Edward Thorpe, gives in broad outline the chemistry of lead. As

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

UTILITY AND DURABILITY OF RUBBER AS A JOINTING MATERIAL FOR GAS-MAINS. *Walter Hole.* An exceedingly interesting review of underground durability of rubber in contact with oils condensed from manufactured gas. *Gas Journal* (London), Nov. 21, p. 504.

WASTE HEAT AND ITS INSULATION FROM GLOVER-WEST VERTICALS AND OTHER CARBONIZING PLANTS. *J. S. Thorman.* A report on the possibilities of waste heat recovery in coal-carbonizing equipment with operating data from a a large British installation. *Gas Journal* (London), Nov. 28, p. 577.

NEW SOURCE OF HIGH-GRADE COKING COAL. *H. M. Chance.* A description of the sand flotation method of separate low-ash from high-ash coal, which permits the use of much coking coal formerly wasted. *Iron Age*, Dec. 27, 1923, pp. 1713-4.

ALCOHOL FROM SULPHITE LYES. *Martin L. Griffin.* A discussion of the economic factors entering into alcohol recovery, showing why recent propositions for conducting this operation are not feasible at present. *Paper*, Dec. 20, 1923, pp. 8-9.

PAPER DRYING. *T.A.P.P.I. committee on drying.* A code is presented for the tabulation of data to establish most economical manner of operating drying equipment, especially in a paper mill. Principles are capable of application to drying other materials. *Paper Trade Journal*, Dec. 27, 1923, pp. 49-51.

METALLURGICAL REQUIREMENTS OF REFRACTORIES FOR USE IN THE ALUMINUM INDUSTRY. *Robert J. Anderson.* A discussion of refractories used in melting pure aluminum and aluminum alloys. *Brass World*, December, 1923, pp. 405-406.

in numerous other industries, the art is frequently in advance of the science, so that it is sometimes impossible to elucidate satisfactorily the chemistry of a particular operation. The author feels, however, that such critical discussion of the problems confronting this industry will serve to encourage the research that is necessary for their solution. Accordingly, throughout this discussion of lead and its compounds, emphasis is placed upon the chemical rather than the purely technical aspects.

Men in the Profession

AMOS N. BARRON, formerly assistant general manager of the National Carbon Co., Cleveland, Ohio, has become head of the Barron-Alexander Co., of the same city, recently organized to deal in securities.

EUGENE C. BETZ, vice-president of the Consolidated Paper Co., Monroe, Mich., has been elected president of the Monroe Exchange Club, formed of local business executives, for the ensuing year.

GEORGE C. BINGHAM, manager of the Crocker plant of the American Agricultural Chemical Co., Buffalo, N. Y., retired on Jan. 1, after 41 years of continuous service with the company. He will continue to reside at Buffalo. SHEPARD KIMBERLY, local treasurer at the plant, will succeed Mr. Bingham as manager.

J. M. BLAKE, metallurgist, American Manganese Steel Co., has been appointed general manager of the foundry in Denver, Colo., which his company purchased recently from the Queen City Foundry Co.

Dr. J. F. BREWSTER, research chemist, Louisiana Sugar Experiment Station, spoke before the members of the Louisiana Section of the American Chemical Society at its regular monthly meeting at the Louisiana State Museum, New Orleans, Dec. 21, on "A Discussion of Some of the Methods of Analysis of Sugar-House Products."

HENRY H. CHAO, who was graduated from the University of Wisconsin last June and since then has been doing work in hydrolysis of cellulose at the U. S. Forest Products Laboratory, is now connected with the Calco Chemical Co., Bound Brook, N. J., as an application chemist.

E. H. HASLAM of Chicago, Ill., has been elected president and general manager of the Hadfield-Penfield Steel Co., Bucyrus, Ohio, with headquarters at the main plant at the last-noted place. He was formerly vice-president of the McIntosh-Hemphill Co., Pittsburgh, Pa. Mr. Haslam will succeed W. F. MILLS, who has returned to England with the Hadfield interests at Sheffield.

Dr. D. B. KEYES is now in charge of research and development for the U. S. Industrial Alcohol Co. in Baltimore, having been transferred from the New York office.

Dr. L. O. HOWARD, chief of the Bureau of Entomology, United States Department of Agriculture, has been awarded the Cross of Chevalier of the Legion of Honor by the Government of France for his services to world agriculture. The decoration of the order has been received in Washington and deposited with the Department of State in accordance with the law of 1881.

L. P. MILLER has left the National Aniline & Chemical Co., Buffalo, N. Y., to accept a position as control chemist for the West Virginia Pulp & Paper Co., Inc., Piedmont, W. Va.

O. O. RIESER is now manager of the molded products department of the Richardson Co. of Cincinnati, Ohio.

GEORGE M. ROLPH, general manager of the California and Hawaiian Sugar Refining Corporation, San Francisco, Calif., gave a holiday party to all officials and employees at the refinery, Crockett, Calif., on Dec. 22.

ADOLPH G. ROSENGARTEN, president of the Powers-Weightman-Rosengarten Co., Philadelphia, Pa., manufacturer of chemicals, has been elected a director of the Philadelphia National Bank.

Calendar

AMERICAN CERAMIC SOCIETY, Atlantic City, N. J., Feb. 4 to 9.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 25 to 28.

AMERICAN ENGINEERING COUNCIL of the Federated American Engineering Societies, Washington, D. C., Jan. 8 to 11.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, New York City, Feb. 18 to 21.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, annual meeting, New York City, Jan. 22 to 25.

AMERICAN SOCIETY OF SAFETY ENGINEERS, annual meeting, New York City, Jan. 18.

AMERICAN SOCIETY FOR STEEL TREATING, winter sectional meeting, Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1.

CANADIAN NATIONAL CLAY PRODUCTS ASSOCIATION, Prince George Hotel, Toronto, Ont., Feb. 13 and 14.

COMMON BRICK MANUFACTURERS' ASSOCIATION, Biltmore Hotel, Los Angeles, Calif., Feb. 11 to 14.

ENGINEERING INSTITUTE OF CANADA, annual general meeting, Montreal, Jan. 22, and Ottawa, Jan. 23 and 24.

FRANKLIN INSTITUTE, annual meeting, Philadelphia, Jan. 16.

SOCIETY OF AUTOMOTIVE ENGINEERS, annual meeting, simultaneously with the Detroit Automobile Show, General Motors Bldg., Detroit, Mich., Jan. 22 to 25.

SOCIETY OF CHEMICAL INDUSTRY, Perkin medal award, Rumford Hall, Chemists' Club, New York, Jan. 11.

TAYLOR SOCIETY, Regular meeting, Engineering Societies Bldg., New York, Jan. 24 to 26.

L. M. ROSSI, manager of the Bakelite Corporation of America, spoke before the members of the Pittsburgh Metric Association, Hotel Fort Pitt, Pittsburgh, Pa., on Dec. 27, on the advantages of the metric system of weights and measures.

VLADIMIR TUMA, chemical engineer, formerly the director of the technical library of the B. F. Goodrich Co., Akron, Ohio, is now connected with the General Laboratories of the U. S. Rubber Co., New York City.

FRANK C. WIGHT, managing editor of *Engineering News-Record*, has been made editor, succeeding E. J. MEHREN, who, as vice-president of the McGraw-Hill Co., Inc., will devote his time to the executive management of the Engineering Unit of the company's publications, comprising *Chemical & Metallurgical Engineering*, *Engineering News-Record*, *Engineering & Mining Journal-Press* and *Coal Age*. Mr. Wight joined the staff of *Engineering News* in 1906 as associate editor, becoming managing editor in 1913. This position he occupied until *Engineering News* and *Engineering Record* were consolidated in 1917 and 4 years later he became managing editor of the combined journal.

Obituary

RUSSELL L. DUNN, of San Francisco, Calif., mining engineer and authority on hydraulic mining, died recently at the local St. Francis Hospital, aged 65 years. He is survived by a son, S. P. Dunn, and a daughter.

WILLIAM W. HEROY, prominent in the glass-manufacturing industry, died at his home in Stamford, Conn., Dec. 26, aged 70 years. He was one of the organizers of the Manhattan Plate Glass Co., and later become identified with the Pittsburgh Plate Glass Co., when that organization absorbed the Manhattan company. He was also a director of the Central Leather Co.

WILLIAM H. RICHARDSON, district engineer for the Utah-Idaho Sugar Co., was killed recently in an automobile accident at Idaho Falls, Idaho. He was 56 years of age and had been connected with the company for the past 13 years.

ERSKINE DOUGLAS WILLIAMSON, physicist in the geophysical laboratory of the Carnegie Institution of Washington, died recently in George Washington Hospital, Washington, D. C., after a brief illness. Although only 37 years old, Mr. Williamson had won for himself a high position in scientific circles in Washington and his reputation had spread around a wide circle of mathematical physicists and physical chemists, both in the United States and abroad. He was graduated from the University of Edinburgh, receiving the degree of Bachelor of Science in 1908 and Master of Arts in 1909.

News of the Industry

Summary of the Week

Exploitation of large potash deposits in Spain will begin shortly.

Schedules mailed early to manufacturers to hasten Census of Dyes and Fine Chemicals for 1923.

Germany expected to compete more keenly for indigo business of the Far East.

Daily average production of crude petroleum in this country in November was 2,150,066 bbl., which was the highest for the year.

Starch dust explosion at Pekin, Ill., kills many.

Judge Hugh Morris has stated that he would entertain a motion to dismiss the government suit against the Chemical Foundation.

Chemical Equipment Association announces that plans have nearly reached the final stage for an exposition of chemical equipment and apparatus.

Swedish inventor develops novel type of electric furnace promising to glass industry.

Embargo prospect booms exports of Canadian pulpwood and paper.

Irregular Prices for Chemicals in Closing Month of Year

Weighted Index Number Declines During December—Imported Chemicals Continue as Factor in Establishing Market Values—Consuming Demand Largely Restricted to Immediate Needs

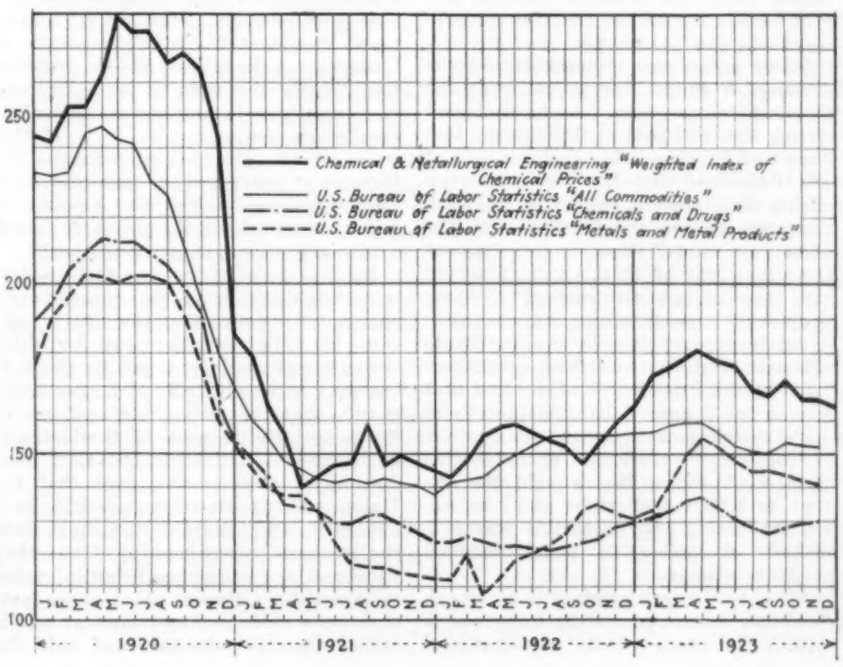
MANUFACTURING industries that are large consumers of chemicals operated on a curtailed schedule in the closing weeks of last year, which had a proportionate effect upon the call for chemicals and other raw materials. Contract buying for delivery over all or part of 1924 was not prominent, and consumers for the most part were content either to secure supplies against orders previously placed or to buy for current requirements in the spot market. In many cases it was stated that purchases were deferred until after the inventory-taking period.

Fluctuations Are Narrow

With few exceptions fluctuations in market values were narrow and some of the basic chemicals appear to have reached a steady price level. Nevertheless the weighted index number of *Chem. & Met.* reached the lowest level of the year, the number standing at 164.43, which compares with 166.22 at the end of November and 165 on Dec. 31, 1922. This means that the steady upward climb of values in the first 4 months of the year had been more than counterbalanced by price recessions through the summer months and in the last quarter of the year. Among the selections on which lower prices were named are prussiates, liquid chlorine, permanganate of potash, formaldehyde, citric acid and tartaric acid.

Chemicals of foreign origin continued to compete with domestic products and had considerable weight in reducing values. This was true despite the fact that the latest official returns, covering the month of November, showed a very material falling off in importations. Owing to its possible effect on future imports of certain chemicals, wide interest was shown in a suit instituted against the Tariff Commission by a prominent importing company. This action is expected to test the validity of the flexible provisions of the tariff law. Consequently upon the outcome of this suit will depend whether or not it is permissible to change existing customs duties as provided for in the Fordney-McCumber act. In the meantime the Tariff Commission is going ahead with its original program and has scheduled different hearings for the early part of the year.

Wholesale prices for commodities as reported by the U. S. Bureau of Labor moved downward in November, the weighted number being 152 for that month, as compared with 153 for October. For the chemical and drug group, however, the bureau records a gain from 129 in October to 130 in November. Metals and metal products, according to the same authority, declined to a rating of 141 in November, as against 142 for the preceding month.



Court Upholds Sale of German Patents to Chemical Foundation

Government to Appeal Decision Handed Down by Judge Morris Dismissing Case From Wilmington Court

THE Chemical Foundation has won its case as far as the U. S. District Court is concerned. In a decision of 20,000 words handed down on Jan. 3 by Judge Hugh M. Morris, the contention of the Foundation was upheld that President Wilson was within his rights when he ordered the seizure of German dye and chemical patents and that the Alien Property Custodian's office was fully authorized to sell German patents.

> I am not the least bit surprised by this decision, which was fully expected. The trend of the case right straight through indicated that such would be the decision. There were so many novel points to the issue that it would be difficult to expect any other result. The only part I played in the case was as a witness for the government. I have nothing but the greatest respect for Judge Morris and I think that he rendered the only decision possible. The case now undoubtedly will go to the Supreme Court. Further than this there is nothing that I can say. —*Herman A. Metz*, Chemical and Dyestuff Importer.

Further, Judge Morris rebukes the government for bringing charges against the defendant which the evidence (3 million words of it!) does not in any way bear out. The outcome of the trial therefore is dismissal—but upon hearing this decision Attorney-General Daugherty stated that the case will be carried to the United States Supreme Court for ultimate decision and that he has confidence that the government will win its case yet.

Many points are brought out in the decision of Judge Morris justifying his dismissal of the case. As he indicated during the trial held in Wilmington last June and July, he holds that the acts of the President and his Cabinet, when within their powers, cannot be nullified. Congress passed the trading with the enemy act, and Wilson, in carrying out the provisions of that act, represented "the supreme law with respect to enemy property." Such circumstances validated "every act done by a subordinate officer in obedience to orders (so authorized) by the President." Asserting that it was "no longer debatable that there were restrictions upon the war power of Congress to confiscate enemy-owned property," Judge Morris said the extent to which that right shall be exercised during any particular war is a matter of policy to be determined solely by Congress.

"Courts may inquire," he said, "whether an act passed by Congress is within the scope of its constitutional power. Beyond that they may not go."

One of the major contentions of the government in its suit for the return of the patents seized and sold to the Foundation for $271,000 was that the transfer was accomplished through "a combination, scheme and conspiracy of certain representatives of the chemical and dye industry." It was particularly implied that Francis P. Garvan, acting as Alien Property Custodian, violated the criminal laws when he sold to himself, as a public trustee, the patents in question. Judge Morris in his decision finds that proof of conspiracy is lacking, that the evidence supporting the charge "has failed utterly notwithstanding the generality of the allegations and the unlimited opportunity offered the plaintiff to support them."

Justifies Custodian's Act

The court held that the sales in dispute were not made by the Custodian in his capacity as a common-law trustee, but under the extraordinary powers devolving upon him, as the President's representative, under the additional sections of the trading with the enemy act. "Because a trustee with only the usual powers may not ordinarily sell trust property at private sale for less than its fair monetary value it by no means follows that the Custodian, acting under supervision and direction of the President, may not do so," held the court. "Obviously, the primary purpose of the act was the protection of the nation, not the benefit of the enemy. The trust was for the benefit of the nation —a public, not a private trust. The statute requires the President to consider the public interest. Public interest is not a synonym for money."

In this relation Judge Morris quoted from President Coolidge's message to Congress on the Muscle Shoals problem, that "while the price is an important element, there is another consideration even more compelling. . . . If this main object [low-priced nitrates for farmers in peace and the government in war] is accomplished, the amount of money received for the property is not a primary or major consideration."

By thus pointing out the facts underlying his decision on the government's charge of criminality, the court indicates his belief that the price for which the sale was made, charged by the government to be absurdly low, was irrelevant—that the disposition and use of the patent rights were of fundamental importance. Although Dr. Carl Holderman, a German, asserted that the Haber patents alone were worth $17,000,000 to the Germans, the court finds the evidence overwhelming "that they were and are without substantial value to American citizens. Had these patents been sold to Americans at public rather than private sale and only the net proceeds paid to their former enemy owners, these owners would have suffered an almost total loss in the value of their property. . . . If in his judgment [Alien Property Custodian] the widespread use of this trust property would tend to advance the safety of the nation, the health of its citizens or the permanence of peace, the property may, in its disposition, be devoted to the public use even though thereby its monetary value for purposes of sale would be substantially destroyed."

Commenting on the charges brought of deliberate attempt to subsidize private industry in this country through this transfer, Judge Morris says:

"This challenge to the motives of the officers making the sale is supported, I think, neither by the facts nor the law. Mr. Polk determined the public interest would be best served by a wide use of the inventions covered by the patents. If the property was sold under terms and conditions that assured its being devoted to the public use, it matters not what benefits or detriments may have flowed as incidents therefrom."

> I and my associates are very much gratified. But this is only one more victory in a struggle that has now been going on for 6 years and must go on for many years more before our country has become chemically independent.
>
> Germany does not intend, even though this decision is a setback, to give up her attempts to regain her world monopoly of organic chemistry, with all it meant to her of military preparedness and supremacy, industrial efficiency and control of the drugs needed by the sick of the world.
>
> This is a bitter, many-fronted battle for the national defense, the industrial progress and the freedom from diseases of our children and our children's children. It is worth while.—*Francis P. Garvan*, President of the Chemical Foundation.

Starch Dust Explosion Causes Large Loss of Life

Forty employees are dead or missing as a result of an explosion and fire which on Jan. 3 destroyed two buildings of the plant of the Corn Products Co. at Pekin, Ill. Fifty others were injured, several of them probably fatally.

It is generally believed that the disaster was the result of an explosion of starch dust, ignited probably by an electric spark or possibly by the match of a smoker; this in spite of the fact that the dust is stated to have contained 12 per cent of moisture. As usual in such cases a complete investigation will be made by the Bureau of Chemistry of the Department of Agriculture. But for the fact that the explosion took place after the factory was closed for the night, the loss of life would have been greater.

Washington News

December Figures for Imports of Dyes Ready Jan. 8

Dye imports through the port of New York during December will be available Jan. 8, it is expected. While the department has taken off these figures throughout the entire year except the first 15 days of January, the totals of each of the monthly reports cannot be added together to obtain an accurate estimate of the year's imports. In the first place, the figures show imports at New York only and do not attempt to cover shipments received at other ports. Moreover, the personnel engaged in this work is not sufficient to go through even the New York list in such a manner as to tally all of the small consignments. The idea of the monthly dye list is simply to give a general indication of the trend of imports which can be made available earlier than the figures which include absolutely all imports.

Corrosion Survey Prepared

The first three research information surveys on corrosion of metals by H. F. Whittaker are now nearing completion and will be ready for distribution about Jan. 15. These are valuable digests of the technical literature dealing respectively with corrosion of nickel, corrosion of aluminum and corrosion of copper. The three mimeographed surveys will be bound together in one pamphlet, which can be obtained by those having need of them for research work. Inquiries should be addressed to Research Information Service, National Research Council, Washington, D. C. It is requested, however, that those not having urgent need of the material for engineering design or research work refrain from asking for these documents, as the supply available is limited.

Fraudulent Drawbacks on Dyes Re-exported From Italy

Protection against customs drawback frauds in connection with dyes is ample, in the opinion of Ernest W. Camp, head of the Customs Division of the Treasury Department. A spectacular fraud of this character in Italy had led to inquiries as to the possibilities of its being perpetrated here.

In Italy large amounts were collected in drawbacks on alleged re-exports of dyestuffs. Instead of the actual imported dyes being processed and re-exported, the material sent out of the country was colored sand.

Customs officials state that there are very few applications for drawbacks on foreign dyes which may be re-exported from the United States. All requests for drawbacks are subjected to very close scrutiny, which is particularly the case when the request comes from an applicant with whom the customs officials are not acquainted. There are re-exports of dyes from this country, but for the most part they are simply transshipments and never leave the custody of customs officials.

So far as can be ascertained without a detailed search of the records, there has been no application for drawback in this country on foreign dyestuffs subjected to further manufacture in this country and re-exported.

Embargo Prospect Booms Canadian Pulpwood Exports

The possibility of an embargo upon the export of pulpwood from Canada to the United States has had the effect, apparently, of greatly stimulating the shipment of pulpwood from the dominion during the last 12 months. According to the report by the Dominion Bureau of Statistics, there was 1,416,558 cords of pulpwood shipped out of Canada in the 12 months ended November last, valued at $13,746,475, compared with 971,968 cords, valued at $10,003,526, for the same period last year.

There were also increases in exports of bleached and unbleached sulphite pulp and in ground woodpulp. Book papers, paper board and wrappings also showed good increases.

Schedules Mailed for 1923 Census of Dyes

Schedules for the "Census of Dyes and Other Synthetic Organic Chemicals, 1923," were mailed to manufacturers Jan. 2 by the Tariff Commission. As the commission was able last year to complete its 1922 census a month earlier than previously, so an effort will be made to complete the 1923 statistics even earlier.

In order to relieve manufacturers of the necessity of filling out two schedules at different times for separate governmental agencies, a co-operative arrangement has been made between the Tariff Commission and the Bureau of the Census whereby the commission mailed with its schedule a copy of the "chemical manufacturers" schedule of the Census Bureau. Both schedules are to be returned to the Tariff Commission, which will transmit to the bureau the schedule belonging to it.

The Tariff Commission's schedule is forwarded in duplicate, one copy to be retained by the manufacturer. The schedule is in practically the same form as that issued last year, with minor improvements dictated by the experience of the last census. It applies to all products from a coal-tar base, either wholly or in part, crudes, intermediates, dyes, color lakes, photographic developers, medicinals, flavors, perfumes, chemicals, synthetic resins and tanning materials, and also to synthetic organic chemicals of non-coal-tar origin.

The information regarding world production of coal-tar products and world distribution which was included in the commission's census for 1922 and which was regarded as particularly valuable by the trade will be included in the 1923 census, as will an analysis of the import and export coal-tar and other synthetic organic chemical trade of the United States.

Pennsylvania Ranks High in Ceramics

From government statistics just compiled for 1923 it is shown that the State of Pennsylvania takes a high rank in the production of burned clay products of all kinds, with firebrick and facebrick output exceeding those of any other state in the Union. The production of the first noted aggregated 200,402,000 in 1923, with an estimated valuation of $8,596,597, while facebrick totaled 223,706,000, with valuation of $4,778,635. The gross production in the state for the year noted was $31,040,432 for burned clay goods of all varieties, ranking next to Ohio, with a valuation of output of $34,094,603. Illinois is third on the list and New Jersey fourth, with valuation of $11,528,514 in the last-noted state. The number of wage earners in the industry in Pennsylvania is placed at 12,072, or about 1,000 more than in Ohio. In the different branches of manufacture, the following figures obtain for the state: vitrified paving brick, 77,919,000, $2,019,968; sewer pipe, 107,002,000, $1,758,919; hollow building tile, 196,847,000, $893,326; floor tile, 47,015,000, $124,885; drain tile, 19,268,000, $153,641. The gross production of burned clay products in the entire country during 1923 is estimated at $194,329,421 in valuation.

Alcohol Forced on Sellers of Motor Fuel in France

A report from Chester Lloyd Jones, commercial attaché at Paris, says that the government's plans for forcing the sellers of motor fuel to take certain quantities of the national alcohol stocks to be mixed with motor fuel are developing slowly. A comptoir has been created among the sellers of gasoline, and began actual work early in November. This body receives the alcohol deliveries from the government and arranges for the mixing of the so-called "carburant national," and its delivery to the oil interests in such proportion as their purchases require. Up to the present time the government has not turned over to the oil interests as large amounts of alcohol as it has a right to under the legislation. Deliveries of alcohol occur month by month, and amounts which the government does not deliver in one month cannot be made up by increasing deliveries later. The mixture of alcohol and gasoline which is now being delivered is turned over to the big omnibus companies and taxicab companies.

News in Brief

Industrial Standardization Progresses—During the past year industrial standardization has continued to develop as one of the most active and important phases of American industry, says O. W. Whitney, chairman of the American Engineering Standards Committee. Progress has been made in the standardization of raw materials, manufacturing processes and finished products. This is equally true whether looked at from the point of view of the factory, of the industrial or technical association, or of a national movement.

To Manufacture Tin and Byproducts—Tin goods of all kinds are to be manufactured in Hamilton, Ont., by Electro Tin Products, Ltd., recently incorporated for $1,000,000. The company will also deal in ores, metals and the byproducts.

Ceramic Exhibit at Pittsburgh—The annual Pittsburgh Glass and Pottery Exhibit will be held for 3 weeks at the Fort Pitt and William Penn hotels, Pittsburgh, Pa., from Jan. 7 to 26, inclusive. About 100 manufacturers of table, porcelain and glassware have contracted for space, absorbing practically the entire allotments. The exhibit will be carried out under the direction of the Associated Glass and Pottery Manufacturers, organized to perpetuate the annual show and to operate without profit.

Metal and Mineral Output High—Canada during 1923 produced more coal, lead, cobalt and asbestos than during any year since mining records have been kept. The output of coal was in the neighborhood of 17,300,000 tons, or 635,000 tons better than the previous record, and 2,000,000 more than the 1922 output. The production of copper, nickel, cement and asbestos was also much above that for the preceding years.

G. E. Endows Research in Germany—According to recent announcement by E. W. Rice, Jr., honorary chairman of the board of directors, General Electric Co., Schenectady, N. Y., this company has arranged for the assistance of pure electrophysical research in Germany for a year under a committee consisting of the eminent and well-known scientists Max Planck, Professor Haber, Drs. Nernst, Laue and Franke.

Ohio Tire Plant Reopens—The Mason Tire & Rubber Co., Kent, Ohio, is planning to resume operations at its plant at Bedford, Ohio, early in January on a 24-hour production basis. The mill has been on a curtailed schedule for some time past. It is expected to develop maximum output within a month. D. M. Mason is general manager.

Equipment Exposition Definitely Planned

Plans for an exposition of chemical equipment and apparatus to be held under the management of the Chemical Equipment Association have reached all but the final stage and members of the association and other interested companies may shortly expect a definite announcement on the subject. An authorized statement to this effect was issued as a result of the important meeting of the officers and directors of the Chemical Equipment Association held recently at the Chemists' Club, New York. At that time an extended report was made by the exposition committee, created last September by order of the annual meeting.

The board of directors also announced that the committee's survey of opinion throughout the equipment and apparatus field on questions of general exposition policy and necessity had resulted in an overwhelming approval of the type of equipment, accessories and essential raw products exposition that had been outlined by the association's committee in a letter to large numbers of equipment houses.

Reports of other committees were reviewed, particular attention being given to the work of the standardization committee, until recently under the chairmanship of Hamilton Allport, E. B. Badger & Sons Co., who under pressure of other matters has relinquished it to P. E. Landolt, Research Corporation.

The growth made by the association in recognition by the chemical industrial field as a headquarters for equipment information was a special point of comment by President T. C. Oliver in a résumé given of 1923 activities. He reported that queries are received by the association from all over the world and from a score of different industries, based to a greater or less degree on chemistry, as to sources of various equipment and apparatus. Individual members of the association, according to President Oliver, have received very important benefits along the lines of direct business.

Slovakian Industry Wants Aid

The papers report that the Smolnik pyrites mines and the mines and chemical works at Pernek (Slovakia) have submitted proposals to the Czechoslovak government suggesting that the latter should lend them assistance in view of a resumption of exploitation. The form of the government's participation in these enterprises has not yet been fixed, but negotiations are being actively pursued.

Early Reservations Desirable for A.C.S. Washington Meeting

The spring meeting of the American Chemical Society will occur at a time when Washington has one of its largest influx of visitors. Even under normal conditions it is impossible to obtain accommodations at hotels unless reservations are made considerably in advance. At the present time there are plenty of good rooms available at all of the large hotels and within easy access to headquarters. However, single rooms will soon be difficult to obtain, and few at minimum rates are available now. It is urged that as many as possible take advantage of double room accommodations, because there are plenty of rooms of this description available.

A list of the principal hotels with a schedule of rates follows. It is recommended that those who desire accommodations communicate directly with the hotels, but if it is desired to have an assignment made by the hotel committee, the chairman, H. C. Fuller, 1845 B St., N.W., will attend to it.

	Single Room,	Single Room, Bath	Double Room	Double Room, Bath
New Willard	$3 up	$5 up	$5 up	$8 up
Washington	.....	$5 up	.....	$8 up
Raleigh	.....	$3 & $4	$4 to $6	$4 to $6
Shoreham	.....	$4 to $7	.....	$6 to $10
Lafayette	.....	.....	.....	$8 up
Powhatan	$3 & $3.50	$4 to $5	$5	$6 to $8
Hamilton	.....	$5	.....	$7
New Ebbitt	$2.50	$3.50	$2 per person	$3 per person
Racquet Club	$3	$3.50	.....	.....

Suites of two rooms with bath at the New Willard are $10 to $12. At the Raleigh suites may be had for $5 to $10. Suites of two rooms with bath for three persons at the Powhatan are $12 to $14. The New Ebbitt offers suites of two rooms with bath for four persons for $3 per person and suites of two rooms without bath for four persons for $2 per person.

Newly Merged French Companies Increase Dye Production

The newly fusioned Etablissements Kuhlmann and the Compagnie Nationale de Matières Colorantes form collectively the most powerful chemical and dyestuffs combination in France. At the moment France is able to supply entirely from home production the needs of her textile industries and others using coloring matter. During the last 3 months the dyestuffs branch of the new combination has averaged a monthly production of 700 metric tons, 581 tons in September, 648 tons in October and 830 tons in November.

Cuba Proposes Bounty on Exports of Alcohol

An export tax of 1c. per gal. on all molasses and "meladura" exported from Cuba, and a bounty on the exportation of all alcohol, natural, denatured, or blended as motor spirit, of 60 per cent or more alcohol content, has been proposed in the Cuban Congress. The bounty on the exportation of alcohol would be figured on the basis of 4c. per gal. of pure alcohol.

Financial

The Atlas Powder Co. has declared regular quarterly dividend of 1¾ per cent on preferred stock of the company, payable Feb. 1.

Serial debenture bonds of the Gulf Oil Co., amounting to $16,000,000, have been underwritten by a syndicate of New York and Pittsburgh bankers.

The Canadian Industrial Alcohol Co. declared a quarterly dividend of 1¾ per cent, payable Jan. 7. This increases the annual rate to 6 per cent, from 4 per cent.

The International Agricultural Corp.'s report covering the fiscal year ended June 30, 1923, shows a deficit of $10,-211,962 after payment of all expenses and charges and including special reserves for inventory depreciation and other accounts.

A special meeting of stockholders of Corn Products Refining Co. has been called for March 25 to approve an increase in the authorized common stock from $50,000,000 to $75,000,000, changing the par value of the common from $100 to $25, and to vote on a proposal to reduce the authorized preferred stock from $30,000,000 to $25,000,000, thus formally completing the retirement of 50,000 preferred shares purchased by the company and canceled in 1921.

Higher Costs May Check German Exports of Indigo

As a result of the recent accord between France and Germany concerning the delivery of reparation dyes, it is expected that Germany will be a much more powerful competitor in the world's indigo markets in 1924 than has been the case at any time since the war.

In that connection, however, it is pointed out that German costs are on a higher level than ever before. The Americans, British and Swiss are now so well intrenched in the Orient that it is believed Germany will have a real struggle for any orders she may get. The uncertainties of the German economic situation are such that there probably will be no disposition to sacrifice profits or sell at a loss in the hope of recouping on the business of subsequent years.

Potash Deposits in Spain

According to a report published by the *Boletín del Instituto Geológico de España* the latest investigations of the potash deposits of Spain discovered in Catalonia show that they extend over an area 42 kilometers long and 15 kilometers wide. Out of twenty-three borings made nineteen have encountered the deposit, one at too great a depth for exploitation, the others at suitable depths. The best-known deposit lies at a depth of 200 to 800 meters. At present the contents are estimated at 2,000 million tons of raw material.

Crude Petroleum Production Highest in November

According to a report from the U. S. Geological Survey the daily average production of crude petroleum in the United States in November, measured by the quantity transported from the producing properties, amounted to 2,150,066 bbl., or an increase of 22,576 bbl. over the daily average for October. Because declines were recorded in the weekly estimates for December, the peak of production was reached in November.

Novel Electric Furnace Invented

A Reuter despatch from Sweden states that the well-known engineer M. Cornelius has invented a new type of furnace called the electrothermic accumulator furnace, by means of which it is possible to control the heating of metals, especially iron and steel, to any degree desired up to 1,300 deg. Celsius. The invention has also solved the problem of the electrical manufacture of uncolored window glass. A 6 weeks trial made with the furnace at the Stridsberg & Bjoerk workshops at Trollhaettan is said to have yielded extremely good results.

Trade Notes

The Harshaw, Fuller & Goodwin Co. has been granted a drawback on exports of refined glycerine produced from imported crude glycerine.

A meeting of the Paint, Oil & Varnish Club of New York will be held at the Biltmore Hotel on the evening of Jan. 16. It will be the annual "Ladies' Night" affair of the club.

The annual celebration of the New York Produce Exchange was held last Monday afternoon. Several hundred children were guests of the exchange and were presented with gifts.

W. R. Fisher, formerly vice-president of the National Leather Co., has succeeded George H. Swift as president of the company. Mr. Swift has been elected chairman of the board of directors.

Malcolm McKenzie, who recently resigned as president of McKenzie & Foster, Inc., has formed a company to be known as McKenzie & Co. The new company is located at 75 Fulton St., New York.

The export duty of 25 pesetas per ton on cork in sheets has been removed by a Spanish royal decree, becoming effective Dec. 23, according to advices received from Commercial Attaché Cunningham, at Madrid.

Clifford M. Hickman has been appointed temporary receiver for the Waverly Smelting & Chemical Corporation, Newark, N. J. The company has capital stock issued to an amount of $55,600, and is said to have assets valued at practically twice the amount of liabilities.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	67¼	67⅛
Allied Chem. & Dye	69¼	70⅛
Allied Chem. & Dye pfd.	110¼	111⅛
Am. Ag. Chem.	13⅛	16
Am. Ag. Chem. pfd.	40⅜	46½
American Cotton Oil c't's	9⅜	11¼
American Cyanamid	*89	*86
Am. Drug Synd.	5⅛	5¼
Am. Linseed Co.	17⅛	19
Am. Linseed pfd.	34⅛	37⅜
Am. Smelting & Refining Co.	57⅜	60⅜
Am. Smelting & Refining pfd.	96	96
Archer-Daniels Mid. Co. w.i.	25	27
Archer-Daniels Mid. Co. pfd.	90	90
Atlas Powder	54	54
Casein Co. of Am.	*66	*66
Certain-Teed Products	*31	*30
Commercial Solvents "A"	*40	*40½
Corn Products	160½	157
Corn Products pfd.	119¾	*122
Davison Chem.	73⅜	67⅜
Dow Chem. Co.	*47	*47½
Du Pont de Nemours	130½	133⅜
Du Pont de Nemours db.	86	86
Freeport-Texas Sulphur	12⅜	12½
Grasselli Chem.	*125	*125
Grasselli Chem. pfd.	*105	*105
Hercules Powder	*110	*110
Hercules Powder pfd.	*104	*104
Heyden Chem.	*1½	*1½
Intn'l Ag. Chem. Co. (new)	1	4½
Int'l Ag. Chem. pfd.	7⅛	7⅜
Int'l Nickel	13⅞	13⅜
Int'l Nickel pfd.	80	*81
Int'l Salt	*89½	*89½
Mathieson Alkali	38⅛	40
Merck & Co.	*64	*65
National Lead	145	143
National Lead pfd.	112	112⅞
New Jersey Zinc	*149	*148
Parke, Davis & Co.	*78	*78
Pennsylvania Salt	*86	*86
Procter & Gamble	*138	*140
Sherwin-Williams	30	30
Sherwin-Williams pfd.	*100	*100
Tenn. Copper & Chem.	9¼	9⅜
Texas Gulf Sulphur	61	62½
Union Carbide	*56½	57¼
United Drug	79⅛	82½
United Dyewood	40	*40
U. S. Industrial Alcohol	68⅜	71⅛
U. S. Industrial Alcohol pfd.	*98	*98
Va.-Car. Chem. Co.	9¼	9¼
Va.-Car. Chem. pfd.	30¾	34½

*Nominal. Other quotations based on last sale.

Perkin Presentation Planned

The presentation of the Perkin medal to Frederick M. Becket is to be made at the regular meeting of the American Section of the Society of Chemical Industry to be held at the Chemists' Club, New York, on Jan. 11. Following a dinner several speakers are to take part in the program.

Ralph H. McKee will deliver some introductory remarks and J. H. Critchett will speak on "Impressions." Clinton P. Townsend will talk on "Becket and His Work," Charles H. Herty follows with a message from Canada, and Charles F. Chandler will make the address of presentation. It is expected that Dr. Becket will then respond.

Merger of Talc Companies

Reports from Burlington, Vt., state that the Magnesia Talc Co. of Waterbury, the Eastern Talc Co. of Rochester and East Granville and Mills at Johnson, formerly owned by the American Mineral Co., have been merged into the Eastern Magnesia Talc Co., Inc., organized under the laws of Vermont with an authorized capital of $1,500,000.

Market Conditions

Quiet Trading Movement Continues in Market for Chemicals

Some Improvements in Consuming Interest in Latter Part of Week—Imported Selections Easy in Price, but Market in General Holds Steady

TRADING in chemicals was at a standstill in the first half of the week. Improvement was noted later in the period but buying orders were light and there was little change from the condition which set in at the beginning of the holiday season.

The weighted index number was unchanged, which shows that the important materials of the market maintained previous price levels. In fact the chemicals which sellers reported to be easy in tone were not openly quoted at lower price levels but slow demand gave the impression that holders would entertain bids more in buyers' favor than the quoted levels.

It is pointed out that the general price level at the beginning of the year closely coincides with that for 12 months ago. Members of the trade interpret this as an evidence that the inflation of values brought about by active buying in the early part of 1923 has been lost and that prices have returned to a normal level based on producing costs and that a stable market will rule unless another period of active consuming demand should occur and bring about an upturn. In short values are regarded as close to bottom with future fluctuations depending on the volume of industrial operation.

Acids

Some selections of the acid group are seasonably dull and in the case of citric and tartaric acids the tone to values has been easy due partly to the slow demand and partly to competition between domestic and foreign makes. Citric has been held at 46@47c. per lb. for imported, and domestic grades were easy at 48@49c. per lb. Tartaric ranged from 26½c. to 27½c. per lb. for imported and 30c. per lb. for domestic.

Mineral acids have moved into consumption in a fairly regular way but recent buying has not been active and prices are subject to concessions. Improved outlook in the fertilizer trade is expected to result in a larger call for sulphuric acid in the coming season. Nitric and muriatic acids showed nothing new during the week either in the way of price changes or of activity on the part of the buyers.

Foreign grades of oxalic acid are prominent in the local market. Although imports in the past 2 months have not been large, spot offerings are freely offered and prices were none too firm in the past week with reports that 12c. per lb. could be shaded. Domestic is following the imported closely in price.

Sodas

Bichromate of Soda—Producers are carrying numerous orders for 1924 delivery and in some cases sellers appear to have taken on enough business at the low prices and are not competing so keenly. On moderate sized lots 7½c. per lb. is asked but on contracts calling for 500 tons 7½c. per lb. can be done. Chrome ore is holding steady.

Spot Arsenic Easier — Yellow Prussiate of Potash Lower—Tin Salts Unchanged for January Delivery—Alkalis Hold Steady Position — Citric and Tartaric Acids Easy—Nitrate of Soda Dull but Firm.

Caustic Soda—Jobbing prices in the local district were steady. Some consumers stated that they were quoted at the same price levels by various sellers. Producers likewise are holding the contract price at $3.10 per 100 lb. at works. The export movement last month was heavy, combined shipments of all soda products having reached a total in excess of 30,000,000 lb.

Chlorate of Soda — Offerings of imported chlorate were available in the spot market at 6¼@6½c. per lb. Recent buying has been restricted to small lots. Domestic chlorate is quiet with the quotation repeated at 6½@7c. per lb., at works.

Fluoride of Soda—Sellers were more reserved and some reports credit the market with having worked into a better position. At any rate there was no pressure of offerings and asking prices appeared to be firm at 10c. per lb. and upward according to quantity and seller.

Nitrate of Soda—Buyers are holding aloof and see no incentive to take on stocks at prevailing prices. Reports from European markets do not indicate that any extensive buying of nitrate will come from that quarter, yet there is no sign of weakness at primary points. Domestic sellers quote $2.50 per 100 lb. and upward according to quantity and position. The drop in sterling has given a slightly easier feeling in the market.

Nitrite of Soda—Offerings of domestic nitrite have been small and holders of stocks are said to have been paying more attention to outside markets where freight rates were less favorable for the imported material. Quotations are given at 8@8½c. per lb. with imported practically at the same level.

Prussiate of Soda—The market has been relieved of pressure in the past 2 weeks and there is a steadiness to quotations which is not favorable to any immediate decline in values. The lowest price heard for spot material is 11½c. per lb. with some sellers asking 11½c. per lb. Shipments from foreign market were held at 11½c. per lb.

Soda Ash — Reports of a steadier market on jobbing lots were heard and formed the only new feature to trading. Demand was inactive but contract deliveries are being called for by large consumers. Prices are $1.25 per 100 lb. in bulk, $1.38 per 100 lb. in bags, and $1.63 per 100 lb. in bbl. These are contract prices, f.o.b. works, for light ash. Dense ash is offered on contract at $1.35 per 100 lb. in bulk, $1.45 per 100 lb. in bags, and $1.69 per 100 lb. in bbl.

Potashes

Bichromate of Potash — Outside of steadiness in prices asked there is nothing to distinguish the bichromate market. Present buying is decidedly slow. Values range from 9½c. per lb. upward.

Caustic Potash — The spot market was irregular with business hardly active enough to test values. Prices for spot goods ranged from 6¼c. to 6⅝c. per lb. Shipments from abroad were generally quoted at 6⅝c. per lb., but it is possible that this could have been scaled down to 6¼c. per lb. on firm business.

Carbonate of Potash—The previous week closed with sellers eager to reduce holdings and this condition continued throughout last week. The result was that buyers had the advantage. On calcined 96-98 per cent 5½c. per lb. could be done and on 80-85 per cent 5¼c. per lb. represented the market.

Permanganate of Potash—Weak lots have not been entirely taken from the market and while 14c. per lb. was not an open price it was stated that there were sellers at that figure. General asking prices are from 14½c. to 15½c. per lb. Domestic makers have announced no change in price and quote 17@17½c. per lb., at works.

Prussiate of Potash—No trading was reported in the red variety and prices are nominal. Reports have differed regarding the lowest price at which sales have been made but 43c. to 45c. per lb. is regarded as representing current values. Yellow prussiate was lower with spot offerings at 21½c. per lb. Futures were quoted at 20c. per lb.

Miscellaneous Chemicals

Arsenic — Considerable quantities came in from abroad during the week. There was no activity in the market and no change in the quoted price of 13½c. per lb. for spot goods. The general tone was easier, however, due to the larger stocks on hand and it was stated that 13c. per lb. might be done on firm bids. Futures were quoted at 13¼@13½c. per lb. but were not in demand.

Bleaching Powder—The market has been unchanged for some weeks and this is giving confidence and some reports say that buying has been better. A large part of the consuming trade is covered for the early part of the year and the movement from producing points promises to be large. The contract price remains at $1.25 per 100 lb. at works, and January shipments are quoted at the same figure.

Copper Sulphate — Fair inquiry is said to have been shown in domestic sulphate for prompt and for the first quarter of the year. The quotation for large crystals is $4.75 per 100 lb. Imported sulphate is dull. The spot market is nominally quoted at $4.50 per 100 lb. with shipments at $4.30 per 100 lb.

Formaldehyde—First hands seem to be in control of the market and with weak resale holdings absorbed, values are holding at unchanged levels of 10½c. per lb. and upward on a quantity basis.

Pyrites—Acid plants along the coast have been buying in a moderate way but the market is described as dull. Sellers quote imported lump, 1 in. diameter and up, 11½c. per long ton unit of sulphur; furnace size, 2½ in. diameter, 12c. per long ton unit; fines, through ½-in. mesh, 11½c. per long ton unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent iron.

Tin Salts—Producers announced that the price schedule as applied to December deliveries would be continued on January sales. The quotation for tin crystals is 34½@35c. per lb. and for bichloride of tin 13½@13¾c. per lb. Tin oxide shows some variation according to seller but in most quarters the market is described as firm at 51c. per lb.

Salt Cake—Consumption in the last 3 weeks of December is reported to have fallen off with the paper trade showing reduced operations. Considerable quantities are reported to have sold for 1924 delivery with contract prices having ranged from $21 to $23 per ton in bulk.

Sulphur—Deliveries against contracts have been of large volume and call for January goods is said to be quite active. Values are well maintained with producers offering at $16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. N. Y.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	164.43
Last week	164.43
Jan., 1923	174.00
Jan., 1922	147.00
Jan., 1921	181.00
Jan., 1920	242.00
Jan., 1919	262.00
Jan., 1918	281.00

The week's index number shows no change, the major items in the list holding steady in the face of rather quiet trading.

Alcohol

New business in denatured alcohol was not active, but with stocks smaller than a short time ago a firm undertone prevailed in most quarters of the trade. Formula No. 5 completely denatured held at 44½c. per gal., carload lots, drums extra. Formula No. 1, special denatured, closed at 45½c. per gal., carload basis, drums extra. Ethyl spirits was unchanged at $4.78 per gal., in bbl., for the U.S.P., 190 proof. There were no important changes in the methanol situation, offerings being plentiful. Prices held on the basis of 93c. per gal. on the 95 per cent grade, carload lots, cooperage included. The pure, in tank cars, held at 90c. per gal.

Coal-Tar Products

Second Hands Advance U.S.P. Phenol on Spot—Crude Naphthalene Offered Freely from Abroad—Benzene Quiet

PRODUCTION of phenol is well taken care of by existing contracts and dealers find it difficult to secure spot supplies. Manufacturers have been restricting business to direct trading with consumers and second hands are forced to pay higher prices in the outside market. During the past week scattered lots of U.S.P. phenol sold as high as 35c. per lb., immediate delivery. Producers, however, announced no changes in the selling schedule. There was some talk of a firmer market for refined naphthalene, but, up to the close, leading factors appeared anxious for business on the old selling basis. The offerings of crude naphthalene from the other side were plentiful and asking prices scarcely moved.

Benzene was in ample supply. The better feeling prevailing in petroleum products led operators in the coal-tar product to take a more optimistic stand as regards the future. Higher gasoline, according to producers, should stimulate business in motor fuel grades of benzene. Demand for the 90 per cent and pure grades of benzene was quiet. Solvent naphtha held steady on moderate stocks. Xylene was unsettled, supplies being larger in some quarters.

Demand for aniline oil was fair and first hands report a steady market on spot and forward business. The salicylates were firm on fair demand and increased stability in phenol. Pyridine was offered more freely; prices were irregular with the tendency downward.

Market Reports in Detail

Aniline Oil—Trading was reported on the basis of 16c. per lb., carload lots, nearby positions, drums extra. On small lots, immediate delivery, traders held out for 17c. per lb. Aniline oil for red was nominally unchanged around 40c. per lb.

Benzene—Producers offered 90 per cent benzene for immediate shipment from works at 21c. per gal., tank cars, indicating that the market underwent no change in the past week. The pure held at 23c. per gal., tank cars, works. The motor grade is moving into consuming channels at a price determined by the current market quotation for gasoline.

Beta Naphthol—Small lots sold at 26c. per lb., immediate delivery. On carload basis first hands offered supplies at 25c. per lb. The market was steady.

Cresylic Acid—Offerings were liberal and the market was irregular. Several handlers said that they stood ready to meet competition but saw no reason for coming out with an open change in the selling schedule. Prices heard ranged all the way from 65@85c. per gal., depending upon the grade and seller.

Naphthalene—Leading factors offered flake naphthalene for shipment at 6@6¼c. per lb., carload lots, the prices being the same as those quoted a week ago. The undertone was firm based on the assumption that buying on a larger scale should set in shortly. Crude was offered for shipment from the Continent at 2½@3c. per lb., c.i.f. New York, as to grade. Several shipments arrived here in the past week.

Phenol — First hands continued to quote 26c. per lb., but had nothing to offer for immediate delivery so far as the outside trade was concerned. Dealers paid as high as 35c. per lb. for U.S.P. material, in drums, immediate delivery. The market was firm at the close.

Pyridine—The market was inactive and scattered lots sold close to $4 per gal., immediate delivery. On forward material to import prices ranged from $3.25@$3.50 per gal.

Solvent Naphtha—Production in most quarters is sold up and the market is regarded as steady at 23c. per gal. on the water-white, in tank cars, works.

Xylene—Pure material was offered freely and quotations of 45@50c. per gal., in drums, were nominal.

Vegetable Oils and Fats

Crude Cottonseed Steady—Linseed Dull—Olive Foots and Rapeseed Higher—Extra Tallow Advances

NOT much business was placed in the market for vegetable oils and fats in the past week, yet prices in most instances held on a steady basis. Producers feel that the rate of consumption will increase over the next quarter, especially in the drying oils, and this tends to support prices. The firmer position of tallow was a feature. Olive oil foots closed higher. Refined rapeseed oil on spot was raised in sympathy with the recent uplift in futures.

Cottonseed Oil—Sales of crude cottonseed oil did not take in any round lots, but the business that was placed went through at unchanged prices. In the Southeast crude sold at 9½c. per lb., tanks, f.o.b. mills, while in Texas 9⅝c. per lb., tanks, represented the general trading level. Holdings of crude at the mills were reported fairly large, but there was no selling pressure. The option market in prime summer yellow oil on the Produce Exchange was an uninteresting affair. Dealings were moderate and final quotations revealed a slightly firmer tendency in nearby oil. The South supported the May and July options. Cash trade was fair. Export demand failed to improve. Sentiment in the South continues bullish, while locally traders were inclined to favor the bear side. Lard compound was unsettled towards the close, on keen competition, and the range of prices was lowered to 13@13¼c. per lb., carload lots. The increase in the stocks of pure lard in Chicago was disappointing, the total on Jan. 1 amounting to 8,339,144 lb., against 7,017,243 lb. on Nov. 1 and 8,214,580 lb. on Jan. 1 a year ago.

Linseed Oil—Crushers reported a dull market, with prices about unchanged. Early in the week the undertone weakened, following closely upon receipt of lower prices for Argentine flaxseed, but the situation changed a little towards the close and pressure in futures was not so apparent. January-February oil was offered at 90c. per gal., carload basis, cooperage included, while February-March held at 87c. per gal. May-August was offered at 83c. per gal., cooperage terms, but larger consumers could not be interested. Weather conditions in the South American seed producing area were more favorable and the new crop is coming forward in better shape. Private reports received here stated that the quality of the new crop was not up to the high mark set last year. The yield of oil per bu. of seed from the 1922-23 crop was slightly in excess of 19 lb. January-February shipment seed from Buenos Aires was offered here toward the close at $1.90 per bu., c.i.f. New York. Inquiry for Argentine seed became fairly active and this steadied the market considerably. In India the crop situation was reported as favorable and a larger acreage is predicted. Receipts of flaxseed at Minneapolis and Duluth from Sept. 1 to date amounted to 12,400,000 bu. Linseed cake for export was nominally unchanged at $41@$42 per ton.

China Wood Oil—Several shipments arrived from Hankow. The market was inactive, but steady at 21c. per lb., in bbl., immediate delivery. On the Pacific coast tank cars were offered at 20c. per lb., nearby positions.

Coconut Oil—While demand was inactive prices were fairly steady. January forward Ceylon type oil for shipment from New York closed at 8⅜c. per lb., tank cars, and for shipment from the Pacific coast at 8¼c., all positions.

Argentina Flaxseed Exports Show Gain Over 1923

Shipments of flaxseed from the Argentine in 1923 fell a little short of expectations, but turned out to be much larger than in 1922. The United States was the largest buyer, taking almost one-half of the total shipments. The shipments by countries, compared with the preceding year, were as follows:

	1923 Bu.	1922 Bu.
United Kingdom	3,540,000	3,055,000
Continent	13,904,000	16,291,000
United States	20,880,000	12,696,000
On orders	5,284,000	5,074,000
Totals	43,608,000	37,116,000

Corn Oil—Sales of crude oil were reported at 10c. per lb., tank cars, Chicago, an advance of ¼c. for the week. Offerings were light.

Olive Oil Foots—Several lots sold at 9¼c. per lb., an advance of ¼c. The offerings were scanty, reflecting higher shipment prices in Italy. Cables received within the week quoted 9¼c. on prime green foots, c.i.f. New York.

Palm Oils—With markets abroad firm and improvement in the tallow situation holders of palm oil on spot were not inclined to force business. Lagos oil for shipment settled at 7.80@7.85c. per lb., while softs closed at 7⅞c. and Niger at 7.05c., c.i.f. New York.

Rapeseed Oil—Refined rapeseed oil sold early in the week at 76c. per gal., spot, but bids at this figure later were turned down. Nominally the market for spot oil closed at 77@77½c. per gal. On futures prices ranged from 79@80c. per gal. Inquiry was good.

Tallow and Greases—Bids for extra tallow at 8c. per lb. ex plant were turned down. The market was firm and on Friday one lot sold at 8¼c. per lb. Choice yellow grease firm at 6⅛@6⅜c. per lb. House grease settled at 6⅛@6¼c. per lb., loose, carload lots. Oleo stearine offered at 10¼c. per lb., a decline of ¼c. No. 1 oleo oil was offered at 16@16¼c. per lb.

Miscellaneous Materials

Antimony—The market has held a firm position with Chinese and Japanese brands, 10c. W.C.C., 10½@11c. Cookson's "C" grade, spot, 11¼@11½c. Chinese needle antimony, lump, nominal, 6½@7½c. per lb. Standard powdered needle antimony, 7½@8½c. per lb. While antimony oxide, Chinese, guaranteed 99 per cent, 7½c. per lb.

Barytes—A steady movement has continued from primary points with an especially good outlet for the higher grades. Market prices are: Crude $7@$10 per ton, f.o.b. Georgia mines; $15 per ton, f.o.b. New York. Ground, white, $16@$17; off-color, $13@$13.50, crude $7@$8; f.o.b. Baltimore. Water ground and water floated, $26@$28, f.o.b. St. Louis. Crude, 90 to 98 per cent barium sulphate, $8 per ton, f.o.b. mines in Missouri.

Bauxite—Trading was quiet with prices steady at: American, crushed and dried, $5.50@$8.75 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, crushed, $20 per gross ton, f.o.b. shipping points. Foreign red bauxite, French, 5 per cent SiO_2, $5@$6.50; Dalmatian, low SiO_2, $6.50@$7.50 per metric ton, according to grade; also quoted $4.65@$6 for other grades.

China Clay—Demand has been less active following curtailed operations of consuming industries. Market prices are quoted at: crude No. 1, $7; No. 2, $6; washed, $8@$9; powdered, $13@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered $45@$50, f.o.b. New York. 1A grade, refined, $15@$16 per ton, Delaware.

Fullers Earth—Only moderate buying has featured trading with large buyers not yet active. Asking prices are on a basis of: 16 to 60 mesh, $18 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14.50; 100 mesh and finer, $7.50; f.o.b. Florida mines.

Graphite—The market is dull at present and prices have been little better than nominal. Ceylon lump, first quality, is held at 5½@6c. per lb.; chip, 4½@5c.; dust, 3½@4c.

Glycerine—Chemically pure was offered at western points at 16c. per lb. but in the local market sellers held out for 16¼c. per lb. in carlots, and 17c. per lb. for less carlots. All grades in this section are offered sparingly and prices are firm. Soap lye at western points was higher as the asking price was 10⅜c. per lb. for basis 80 per cent, loose. Saponified loose was held at 12@12¼c. per lb.

Naval Stores—There has been little call for turpentine and the market has stood at 92½c. per gal. ex-yard. The undertone is steady as buying is expected to improve in the near future. The lower grades of rosin were easier with offerings at $5.50 per bbl. W. G. rosin was quoted at $7.10 per bbl. and W. W. at $7.50 per bbl.

Imports at the Port of New York

December 28 to January 3

ACIDS—Cresylic—12 dr. London, Order. **Formic**—100 carboys, Hamburg, International Acceptance Bank; 80 demijohns, Hamburg, Innis, Speiden & Co. **Oxalic**—34 bbl., Hamburg, Roessler & Hasslacher Chemical Co.; 45 csk., Rotterdam, R. W. Greeff & Co.

ALBUMEN—10 bbl., Hamburg, Schenckers, Inc.

ALCOHOL—240 bbl. denatured, Arecibo, C. Esteva; 49 bbl. butyl, Havre, De Mattia Chemical Co., Inc.

ALUM—50 csk., Hamburg, Jungmann & Co.

ANTHRACENE — 50 dr. Rotterdam, Lunham & Reeve.

ANTIMONY REGULUS—100 cs. Hamburg. Order; 250 cs., Shanghai, Wah Chang Trading Corp.

ANTIMONY, RED — 200 bbl., Havre, Heemsoth, Basse Co.

ANTIMONY ORE—596 bg., Antofagasta, W. R. Grace & Co.

ANTIMONY OXIDE—250 bg., Shanghai, Wah Chang Trading Corp.

AMMONIUM CARBONATE — 12 csk., Hamburg. A. J. Marcus.

ARSENIC—200 csk., Hamburg, Central Union Trust Co.; 200 csk., Hamburg, Union Trust Co.; 200 bbl., Hamburg, Superfos Co.; 371 bbl., Piraeus, Order; 89 bbl. Tampico, Am. Metal Co.

ASBESTOS — 852 bg. blue, Capetown, Order.

BARIUM CARBONATE—69 csk., Hamburg, Schultz & Ruckgaber; 500 bg., Hamburg, Order; 1,000 bg., Hamburg, Order.

BARYTES—100 csk., London, Order; 80 csk., Hamburg, P. Uhlich & Co.

CAMPHOR — 45 bbl., Hamburg, Nixon Nitration Works.

CALCIUM CHLORIDE—78 dr., Hamburg, Roessler & Hasslacher Chemical Co.

CALCIUM NITRATE—24 csk., Brevik, Order.

CHALK—1,600 bg., London, J. W. Lyon & Sons; 133 csk., Hamburg, Goldschmidt Corp.; 500 bg., Antwerp, L. A. Salomon & Bro.; 3,000 bg., Antwerp, Order.

CHEMICALS—30 csk., Bremen, Order; 40 bbl., Hamburg, Roessler & Hasslacher Chemical Co.; 200 cs., Liverpool. H. W. Peabody & Co.; 11 cs., Hamburg, Pfaltz & Bauer; 37 pkg., Hamburg, Jungman & Co.; 550 cs., Bremen, Roessler & Hasslacher Chemical Co.; 30 bbl., Bremen, Hummel & Robinson.

COAL-TAR DISTILLATE—50 dr. Liverpool, Monsanto Chemical Works; 63 dr., Liverpool, Order.

COLORS — 11 csk. aniline, Rotterdam, Geigy Co.; 16 csk. earth, Hamburg, Reichard-Coulston, Inc.; 25 csk. earth, Hamburg, Order; 3 csk. aniline, Hamburg, Franklin Import & Export Co.; 11 csk. aniline, Hamburg, Irving Bank-Col. Trust Co.; 20 pkg. aniline, Genoa, Irving Bank-Col. Trust Co.; 17 pkg. aniline, Genoa, Order.

CORUNDUM ORE—3,041 bg., Delagoa Bay, C. Hardy & Ruperti, Inc.

CREAM TARTAR — 30 csk., Hamburg, A. J. Marcus, Inc.; 25 keg., Genoa, Austin, Nichols & Co.

DEXTRINE — 400 bg., Copenhagen, Farmers Loan & Trust Co.; 400 bg., Copenhagen, Stein, Hall & Co.

DIVI-DIVI—200 bg., Rio Hacha, Ultramares Corp.

EPSOM SALT — 750 bg., Bremen, E. Suter & Co.; 266 bg., Hamburg, Roessler & Hasslacher Chemical Co.

FATTY ACID — 200 bbl., Rotterdam, Equitable Trust Co.

FUSEL OIL—1 dr. Valencia, Order; 24 csk., Hamburg, Order; 4 dr., Hamburg, Order; 2 dr., Antwerp, Order.

FUSTIC—1,938 pcs., Central America, G. H. Pearson & Son.

FULLERS EARTH—100 bg., London, L. A. Salomon & Bro.

FERROCHROME—200 cs., Havre, Int'l Ores & Metals Corp.

FERROSILICON—1,260 tons, Stavanger, Electric Metallurgical Co.

GAMBIER—201 cs., Singapore, L. Littlejohn & Co.

GLAUBER SALT — 201 bg., Hamburg, Order; 750 bg., Hamburg, E. Suter & Co.

GLYCERINE—95 dr. crude, Hull, Marx & Rawolle.

GUMS — 400 bg. copal, Antwerp, W. Schall & Co.; 400 cs. damar and 670 bg. do, Singapore, Chemical National Bank; 350 bg. copal, 210 bg. damar and 150 cs. do, Singapore, L. C. Gillespie & Son; 770 bg. and 50 cs. damar, Singapore, Kidder, Peabody Accept. Corp.; 100 cs. damar and 100 cs. copal, Singapore, Baring Bros. & Co.; 5 cs. mastic, Chios, D. Costallos; 16 cs. do, Chios, B, Stamoulis Bros.; 20 cs. do, Chios, Order; 200 cs. damar, Batavia, Order; 140 bg. damar, 150 cs. do and 30 cs. copal, Singapore, Kidder Peabody & Co.; 50 cs. damar and 210 bg. do, Singapore, L. C. Gillespie & Sons; 192 bg. damar, Singapore, Chemical National Bank.

ICHTHYOL—36 csk., Hamburg, Merck & Co.

IRON CHLORATE—30 bbl., Hamburg, Order.

IRON OXIDE—75 bbl. Malaga, National City Bank; 144 bbl., Malaga, Reichard-Coulston, Inc.; 25 bbl., Malaga, L. H. Butcher & Co.; 228 bbl. Malaga, C. J. Osborn & Co.; 509 bbl., Malaga, C. K. Williams & Co.; 22 bbl. Malaga, Order; 15 csk., Liverpool, Reichard-Coulston, Inc., 35 csk., Hull, J. Lee Smith & Co.

LEAD SUGAR—10 csk., Hamburg, Roessler & Hasslacher Chemical Co.

MAGNESIUM CHLORIDE — 61 dr., Hamburg, American Commerce & Finance Co.; 129 dr., Hamburg, Erie R.R.; 85 bbl., Hamburg, Order.

MAGNESIUM SILICATE—25 csk., Bremen, Pfaltz & Bauer.

MANGANESE ORE—475 tons washed, Batum, Order.

MANGROVE BARK—4,000 bg., Singapore, Order.

MERCURY OXIDE—5 cs., Hamburg, C. B. Richard & Co.

MINERAL WHITE—100 bg., Hull, L. A. Salomon & Bro.

MYROBALANS—1,700 pkt. crushed, Calcutta, Order; 600 bg., Calcutta, Order.

NAPHTHALENE — 1,000 double bags, Hamburg, Manufacturers Trust Co., 1,500 bg., Rotterdam, Lunham & Reeve.

NICKEL SULPHATE — 40 csk., Hamburg, Pfaltz & Bauer.

OILS — China Wood — 60 bbl., London, Order; 90 bbl., London, Order; 587 csk., Hankow, Cook & Swan Co.; 290 bbl., Hankow, Sino Java Handel'g; 625 bbl., Hankow, Asia Banking Corp.; 300 bbl., Hankow, Bank of America; 574 bbl. Hankow, Paterson, Boardman & Knapp; 291 bbl., Hankow, H. P. Winter & Co.; 512 bbl., Hankow, Order. **Cod**—200 bbl., Hull, W. Schall & Co.; 50 bbl. Hull, Cook & Swan Co.; 100 bbl., Hull, First National Bank of Boston; 100 bbl., Hull, Order. **Olive Oil Foots**—34 bbl., Seville. **Palm**—1,795 dr., Matadi, Niger Co.; 483 csk., Burutu, Irving Bank-Col. Trust Co.; 155 csk., Cotonou, Bank Francaise de L'Afrique Equatoriale; 85 csk., Hamburg, African & Eastern Trading Corp. **Rapeseed**—70 bbl., Hull, Balfour, Williamson & Co.; 445 bbl., Hull, Order.

PITCH—100 bbl., Hull, Order.

PLUMBAGO—144 bg., Colombo, Order; 50 bbl., Colombo, Order.

POTASSIUM SALTS — 15 bbl. yellow prussiate, Copenhagen, Order; 4,000 bg. sulphate, Bremen, Potash Importing Corp. of America; 330 dr. caustic, Hamburg, Goldschmidt Corp.; 4 csk. chlorate, Hamburg, Jungmann & Co.; 573 dr. caustic, Hamburg, International Acceptance Bank; 363 dr. caustic, Hamburg, American Exchange National Bank; 39 csk. salts, Hamburg, Roessler & Hasslacher Chemical Co.; 126 bbl. alum, Hamburg, A. Klipstein & Co.; 68 csk. carbonate, Hamburg, Peters, White & Co.; 519 bg. nitrate, Hamburg, Order.

PYRIDINE—6 csk., Rotterdam, Cadwallader & Co.; 12 dr., Rotterdam, Lunham & Reeve.

PYRITES—5,367,000 kilos, Huelva, Pyrites Co.

QUEBRACHO—2,048 bg., Buenos Aires, Order; 970 bg., Buenos Aires, International Products Co.; 2025 bg., Buenos Aires, Fourth Atl. Nat'l Bank of Boston; 3,904 bg., Buenos Aires, First National Bank of Boston.

SAL AMMONIAC—50 bbl., Hamburg, J. Munroe & Co.; 20 bbl., Hamburg, Roessler & Hasslacher Chemical Co.; 89 bbl., Hamburg, P. Bauer & Co.; 26 csk., Hamburg, Meteor Products Co.; 81 csk., Hamburg, Irving Bank-Col. Trust Co.; 18 csk., Hamburg, Farmers' Loan & Trust Co.; 35 csk., Hamburg, E. Suter & Co.

SHELLAC—480 bg., Calcutta, Lee Higginson & Co.; 218 bg. seedlac, 25 chests button and 35 bg. shellac, Calcutta, Bank of America; 200 bg., Calcutta, British Oversea Bank; 334 bg. and 50 cs., Calcutta, Order; 95 bg. garnet. Hamburg. Kasebier, Chatfield Shellac Co.; 65 cs. garnet, Hamburg, F. C. Gerlach; 37 bg., Hamburg, Irving Bank-Col. Trust Co.; 100 bg., Hamburg, Order.

SILVER SULPHIDE — 4 cs., Callao, Markt & Schaefer Co.; 82 cs., Antofagasta, Watson, Geach & Co.

SODIUM SALTS — 256 bg. nitrate, Christiania, Order; 1,327 tons nitrate, Tocopilla, Wessel, Duval & Co.; 2,823 sk. nitrate, Mejillones, Anthony Gibbs & Co.; 13,851 sk. nitrate, Mejillones, Order; 38 csk. yellow prussiate London, Order; 61 csk. fluoride, Hamburg, Roessler & Hasslacher Chemical Co.; 58 csk. fluoride, Hamburg, Order; 148 csk. nitrate, Hamburg, Order; 46 dr. prussiate, Rotterdam, Order; 31 csk. fluoride, Hamburg, Hans Hinrichs Chem. Corp.; 406 dr. sulphite, Hamburg, C. S. Grant & Co.; 31 csk. fluoride, Hamburg, Globe Shipping Co.; 550 bg. sulphate, Hamburg, Order; 5453 bg. nitrate, Antofagasta, W. R. Grace & Co.; 7519 bg. nitrate, Iquique, W. R. Grace & Co.; 3950 bg. nitrate and 134 csk. do, Brevik, Order.

SULPHUR PRECIPITATES — 25 csk., Hamburg, C. B. Richard & Co.

SUMAC — 350 bg. ground, Palermo, Order.

STRONTIUM CARBONATE — 9 csk., Hamburg, Order.

TALC—900 bg. and 10 cs., Bordeaux, L. A. Salomon & Bro.; 30 cs. Bordeaux, Binney & Smith.

TARTAR—96 bg., Bordeaux, Order; 124 bg., Lisbon, C. Pfizer & Co.; 42 csk., Naples, Tartar Chemical Works; 26 bg., Valparaiso, Banko Anglo Sud America.

ULTRAMARINE — 5 csk., Bremen, A. Hurst & Co.; 1 cs., Bremen, Order.

UMBER—19 csk., Hull, Reichard-Coulston, Inc.

VANADIUM ORE—13,251 bg., Callao, Vanadium Corp.

WATTLE BARK — 280 bg., Durban, Hammond, Carpenter Co.; 2,977 bg., Durban, Order.

WAXES — 22 bg. bees, Caibarien, D. Steengrafe, 679 bg. bees, Lisbon, Strohmeyer & Arpe; 43 bg. bbes, Lisbon, Order; 792 bg. paraffine, London, Asiatic Petroleum Co.; 16 bg., Montan, Hamburg, National City Bank; 26 cs. bees, Havana, Order; 55 bg. carnauba, Bahia, Order; 166 bg. do, Ceara, Strohmeyer & Arpe; 221 bg. do, Ceara. P. Drummond; 122 bg. do, Ceara, Order; 42 bg. do, Recife, Elbert & Co.

WHITING—4,839 bg. Dunkirk, Taintor Trading Co.

ZINC CHLORIDE—59 csk., Hamburg, H. Falck & Co.

ZINC OXIDE—1 csk., London, Sherwin, Williams Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

General Chemicals

Acetone, drums	lb.	$0.25 –	$0.25½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.63
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Acetic, 80%, bbl.	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.78
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.46½ –	.48
Formic, 85%	lb.	.12 –	.14
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½ –	.12
22% tech., light, bbl.	lb.	.05½ –	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½ –	.05
Nitric, 42°, carboys	lb.	.05½ –	.05½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.11½ –	.12½
Phosphoric, 50% carboys	lb.	.07½ –	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.26½ –	.27
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol, ethyl (Cologne spirit), bbl.	gal.	4.81 –	....
Ethyl, 190 p'f, U.S.P., bbl.	gal.	4.78 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½ –	...
No. 1, 190 proof, special, dr.	gal.	.45½ –	...
No. 1, 188 proof, bbl.	gal.	.52½ –	...
No. 1, 188 proof, dr.	gal.	.48½ –	...
No. 5, 188 proof, bbl.	gal.	.50½ –	...
No. 5, 188 proof, dr.	gal.	.44½ –	...
Alum, ammonia, lump, bbl.	lb.	.03¼ –	.04
Potash, lump, bbl.	lb.	.03 –	.03¼
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.07 –	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. tech., casks	lb.	.09 –	.09½
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	4.50 –	4.75
Antimony oxide, white, bbl.	lb.	.07½ –	.07¾
Arsenic, white, powd., bbl.	lb.	.13 –	.13½
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl.	ton	68.00 –	72.00
Barium chloride, bbl.	ton	85.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks		.07½ –	.08
Blanc fixe, dry, bbl.	lb.	.04 –	.04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.25 –	....
Spot N. Y. drums	100 lb.	1.75 –	....
Borax, bbl.	lb.	.05½ –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.12½ –	.13
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½ –	.07
Camphor, cases	lb.	.84 –	.85
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.09 –	.09½
Chalk, precip.—domestic, light, bbl.	lb.	.04½ –	.04½
Domestic, heavy, bbl.	lb.	.03½ –	.04
Imported, light, bbl.	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04 –	.04½
Contract, tanks, wks.	lb.	.03 –	....
Cylinders, 100 lb., wks.	lb.	.05½ –	.06
Cylinders, 100 lb., spot	lb.	.08½ –	.09
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	18.00 –	19.00
Copper carbonate, bbl.	lb.	.18 –	.19
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.	100 lb.	4.75 –	4.90
Imp bbl.	100 lb.	4.50 –	....
Cream of tartar, bbl.	lb.	.22½ –	.25½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.05
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums	gal.	.97 –	....

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

Ethyl acetate, 99%, dr.	gal.	$1.12 –	$1.15
Formaldehyde, 40%, bbl.	lb.	.10½ –	.10¾
Fullers earth—f.o.b. mines	ton	18.00 –	20.00
Furfurol, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	4.00 –	4.25
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, e.p., drums extra	lb.	.16½ –	.17
Glycerine, dynamite, drums	lb.	.16 –	....
Glycerine, crude 80%, loose	lb.	.10¾ –	....
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09¼ –	.09¼
White, basic sulphate, casks	lb.	.08½ –	.09
White, in oil, kegs	lb.	.11½ –	.11¾
Red, dry, casks	lb.	.10¼ –	.10½
Red, in oil, kegs	lb.	.13 –	.14½
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg. wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10¼ –	.10¾
Lithopone, bags	lb.	.06½ –	.06¾
in bbl.	lb.	.06½ –	.06¾
Magnesium carb., tech., bags	lb.	.08½ –	.08¾
Methanol, 95%, bbl.	gal.	.93 –	....
Methanol, 97%, bbl.	gal.	.95 –	....
Methanol, pure, tanks	gal.	.90 –	....
drums	gal.	1.00 –	....
bbl.	gal.	1.05 –	....
Methyl-acetone, t'ks.	gal.	1.15 –	....
Nickel salt, double, bbl.	lb.	.10 –	.10¼
Nickel salts, single, bbl.	lb.	.11 –	.11½
Phosgene		.60 –	.75
Phosphorus, red, cases	lb.	.... –	....
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½ –	....
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½ –	.06¾
Potassium chlorate, powd.	lb.	.07½ –	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask.	lb.	.08½ –	.08¾
Potassium hydroxide (caustic potash) drums	lb.	.06½ –	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.07½ –	.09
Potassium permanganate, drums	lb.	.14 –	.14½
Potassium prussiate, red, casks	lb.	.45 –	.48
Potassium prussiate, yellow, casks	lb.	.21½ –	.22
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk)	ton	22.00 –	24.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.10 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05¼
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½ –	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½ –	.04¾
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08¼ –	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½ –	.02½
Sodium nitrite, casks	lb.	.07½ –	.07½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½ –	.04
Sodium prussiate, yel. drums	lb.	.11½ –	.11½
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.03½
Sodium sulphite, crys., bbl.	lb.	.03½ –	.03¾
Strontium nitrate, powd., bbl.	lb.	.11½ –	.12
Sulphur chloride, yel drums	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½ –	.13¾
Tin oxide, bbl.	lb.	.51 –	....
Tin crystals, bbl.	lb.	.34½ –	.35
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½ –	.06¾
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, lead free, bag	lb.	.06½ –	.06¾
5% lead sulphate, bags	lb.	.06¾ –	.07½
10 to 35 % lead sulphate, bags	lb.	.06½ –	.06¾
French, red seal, bags	lb.	.09½ –	.....
French, green seal, bags	lb.	.10½ –	.....
French, white seal, bbl.	lb.	.12 –	.....
Zinc sulphate, bbl.	100 lb.	2.75 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.70
Alpha-naphthol, ref., bbl.	lb.	.65 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 –	.70
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	75	....
Benzene, pure, water-white, tanks, works	gal.	.22½ –	.23
Benzene, 90%, tanks, works	gal.	.21 –	....
Bensidine base, bbl.	lb.	.82 –	.86
Bensidine sulphate, bbl.	lb.	.72 –	.75
Benzoic acid, U.S.P., kegs	lb.	.85 –	.88
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.25 –	.26
Beta-naphthylamine, tech.	lb.	.75 –	.80
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.75 –	.85
95-97%, drums, works	gal.	.70 –	.75
Dichlorbenzene, drums	lb.	.06 –	.08
Diethylaniline, drums	lb.	.49 –	.51
Dimethylaniline, drums	lb.	.39 –	.40
Dinitrobenzene, bbl.	lb.	.18 –	.20
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.30 –	.35
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.06 –	.06½
Naphthalene, balls, bbl.	lb.	.06½ –	.07
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl.	lb.	1.10 –	1.15
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.15 –	.17
Ortho-nitrophenol, bbl.	lb.	1.20 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-amifiophenol, base, kegs	lb.	1.30 –	....
Para-amifiophenol, HCl, kegs	lb.	1.55 –	....
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitroaniline, bbl.	lb.	.70 –	.73
Para-nitrotoluere, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.90 –	.95
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.35
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	4.00 –	4.25
Resorcinol, tech., kegs	lb.	1.40 –	1.50

Resorcinol, pure, kegs	lb.	$2.15 –	....
R-salt, bbl.	lb.	.55 –	.60
Salicylic acid, tech., bbl.	lb.	.32 –	....
Salicylic acid, U.SP., bbl.	lb.	.35 –	....
Solvent naphtha, water-white, tanks	gal.	.23 –	....
Crude, tanks	gal.	.20 –	....
Sulphanilic acid, crude, bbl.	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.24 –	....
Toluene, drums, works	gal.	.29 –	....
Xylidine drums	lb.	.50 –	....
Xylene, pure, drums	gal.	.45 –	.50
Xylene, com., drums	gal.	.34 –	....
Xylene, com., tanks	gal.	.29 –	....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.55 –	.....
Rosin E-I, bbl. 280 lb.		5.55 –	.....
Rosin K-N, bbl. 280 lb.		5.80 –	$6.00
Rosin W.G.-W.W., bbl. 280 lb.		6.90 –	7.10
Wood rosin, bbl. 280 lb.		5.80 –	5.90
Turpentine, spirits of, bbl.	gal.	.92½ –	.....
Wood, steam dist., bbl.	gal.	.84 –	.....
Wood, dest. dist., bbl.	gal.	.68 –	.....
Pine tar pitch, bbl. 200 lb.		5.50 –	.....
Tar, kiln burned, bbl. 500 lb.		11.00 –	.....
Retort tar, bbl. 500 lb.		11.00 –	.....
Rosin oil, first run, bbl.	gal.	.45 –	.....
Rosin oil, second run, bbl.	gal.	.47 –	.....
Rosin oil, third run, bbl.	gal.	.50 –	.....
Pine oil, steam dist.	gal.	.65 –	.....
Pine oil, pure, dest. dist.	gal.	.60 –	.....
Pine tar oil, ref.	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.32 –	.32½
Pine tar oil, double ref., bbl.	gal.	..... –	.75
Pine tar, ref., thin, bbl.	gal.	..... –	.25
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl.	lb.	$0.04 –	$0.04½
Grease, yellow, loose	lb.	.06½ –	.06½
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Neatsfootoil 20 deg. bbl.	gal.	1.30 –	.....
No. 1, bbl.	gal.	.98 –	.....
Oleo Stearine		.10½ –	.10½
Oleo oil, No. 1, bbl.	lb.	.16½ –	.....
Red oil, distilled, d.p. bbl.	lb.	.08½ –	.08½
Saponified, bbl.	lb.	.08½ –	.08½
Tallow, extra, loose	lb.	.08 –	.08½
Tallow oil, acidless, bbl.	gal.	.86 –	.88

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.14½ –	.....
Castor oil, No. 1, bbl.	lb.	.15 –	.....
Chinawood oil, bbl.	lb.	.21 –	.21½
Coconut oil, Ceylon, bbl.	lb.	.09½ –	.....
Ceylon, tanks, N.Y.	lb.	.08½ –	.....
Coconut oil, Cochin, bbl.	lb.	.10 –	.....
Corn oil, crude, bbl.	lb.	.12½ –	.....
Crude, tanks, (f.o.b. mill)	lb.	.10 –	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ –	.09½
Summer yellow, bbl.	lb.	.11½ –	.12
Winter yellow, bbl.	lb.	.12½ –	.13
Linseed oil, raw, car lots, bbl.	gal.	.90 –	.....
Raw, tank cars (dom.)	gal.	.84 –	.....
Boiled, cars, bbl. (dom.)	gal.	.92 –	.....
Olive oil, denatured, bbl.	gal.	1.10 –	1.120
Sulphur, (foots) bbl.	lb.	.09½ –	.....
Palm, Lagos, casks	lb.	.07½ –	.....
Niger, casks	lb.	.06½ –	.07½
Palm kernel, bbl.	lb.	.09 –	.....
Peanut oil, crude, tanks (mill)	lb	.12 –	.....
Peanut oil, refined, bbl.	lb.	.15 –	.15½
Perilla, bbl.	lb.	.14½ –	.14½
Rapeseed oil, refined, bbl.	gal.	.77 –	.79
Rapeseed oil, blown, bbl.	gal.	.83 –	.85
Sesame, bbl.	lb.	.12½ –	.12½
Soya bean (Manchurian), bbl.	lb.	..... –	.....
Tank, f.o.b. Pacific coast	lb.	.09½ –	.....
Tank, (f.o.b. N.Y.)	lb.	.10¼ –	.....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.68 –	.....
Menhaden, light pressed, bbl.	gal.	.64 –	.....
White bleached, bbl.	gal.	.66 –	.....
Blown, bbl.	gal.	.70 –	.....
Crude, tanks (f.o.b. factory)	gal.	.47½ –	.....
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Coconut cake, bags	ton	$34.00 –	....
Cottonseed meal, f.o.b. mills	ton	45.00 –	....
Linseed cake, bags	ton	41.00 –	42.00
Linseed meal, bags	ton	44.00 –	....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½ –	.04½
Cutch, Rangoon, bales	lb.	.15 –	.16
Dextrine, corn, bags 100 lb.		3.59 –	3.69
Dextrine, gum, bags 100 lb.		3.89 –	3.99
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.10½ –	.10½
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	90.00 –	.....
Sumac, ground, bags	ton	$85.00 –	$90.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags 100 lb.		3.02 –	3.12
Tapioca flour, bags	lb.	.06 –	.07

Extracts

Archil, conc., bbl.	lb.	$0.16½ –	$0.20
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09 –	.09½
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.09½ –	.10½
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.07½ –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.05 –	.05½
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.08 –	$0.10
spot, cases	lb.	.10 –	.14
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.45 –	.50
Prussian, bbl.	lb.	.45 –	.50
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½ –	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.12 –	.12½
Paris, bulk	lb.	.26 –	.28
Reds Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.15 –	1.20
Yellow, Chrome, C.P. bbls.	lb.	.17½ –	.18
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl.	lb.	$0.25 –	$0.26
Beeswax, crude, Afr. bg.	lb.	.22 –	....
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.36 –	.38
No. 2, North Country, bags	lb.	.22 –	.22½
No. 3, North Country, bags	lb.	.18½ –	.19
Japan, cases	lb.	.17½ –	.17½
Montan, crude, bags	lb.	.05½ –	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.04½ –	....
Crude, scale 124-126 m.p. bags	lb.	.03½ –	....
Ref., 118-120 m.p., bags	lb.	.04 –	....
Ref., 125 m.p., bags	lb.	.04½ –	....
Ref, 128-130 m.p., bags	lb.	.04½ –	....
Ref., 133-135 m.p., bags	lb.	.04½ –	.05
Ref., 135-137 m.p., bags	lb.	.05½ –	....
Stearic acid, sgle pressed, bags	lb.	.11½ –	.11½
Double pressed, bags	lb.	.12 –	.12½
Triple pressed, bags	lb.	.13 –	.13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$8.00 –	$8.25
Ammonium sulphate, bulk f.o.b. works 100 lb.		2.85 –	2.90
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	4.40 –	....
Nitrate of soda, bags 100 lb.		2.50 –	.....
Tankage, high grade, f.o.b. Chicago	unit	3.25 –	3.35
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	4.00 –	4.50
Tennessee, 78-80%	ton	7.75 –	8.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	27.00 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.22½ –	.....
Upriver coarse	lb.	.18½ –	.....
Upriver caucho ball	lb.	.20 –	.....
Plantation—First latex crepe	lb.	.26½ –	.....
Ribbed smoked sheets	lb.	.26½ –	.....
Brown crepe, thin, clean	lb.	.24½ –	.....
Amber crepe No. 1	lb.	.25½ –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.10 –	$0.15
East Indian, bold, bags	lb.	.20 –	.21
Manila, pale, bags	lb.	.19 –	.20
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.25 –	.....
Singapore, No. 1, cases	lb.	.32 –	.33
Singapore, No. 2, cases	lb.	.21½ –	.22
Kauri, No. 1, cases	lb	.64 –	.66
Ordinary chips, cases	lb.	.20½ –	.21½
Manjak, Barbados, bags	lb.	.09 –	.14

Shellac

Shellac, orange fine, bags	lb.	$0.64 –	....
Orange superfine, bags	lb.	.66 –	....
A. C. garnet, bags	lb.	.65 –	....
Bleached, bonedry	lb.	.72 –	.73
Bleached, fresh	lb.	.60 –	....
T. N., bc	lb.	.60 –	.61

Miscellaneous Materials

Asbestos, crude No. 1, f o b Quebec sh. ton		$325.00 –	$450.00
Asbestos, shingle, f.o.b., Quebec sh. ton		50.00 –	70.00
Asbestos, cement, f.o.b., Quebec sh. ton		17.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl. net ton		16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt. net ton		13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl. net ton		26.00 –	.....
Barytes, crude f.o.b. mines, bulk net ton		7.00 –	10.00
Casein, bbl., tech. lb.		.11 –	.12
China clay (kaolin) crude, No. 1, f.o.b. Ga. net ton		7.00 –	.....
Washed, f.o.b. Ga. net ton		8.00 –	9.00
Powd., f.o.b. Ga. net ton		13.00 –	20.00
Crude f.o.b. Va. net ton		6.00 –	8.00
Ground, f.o.b. Va. net ton		13.00 –	19.00
Imp., lump, bulk net ton		15.00 –	20.00
Imp., powd. net ton		45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C. long ton		6.60 –	7.75
No. 2 f.o.b. N.C. long ton		4.50 –	5.00
No. 1 soap long ton		8.50 –	.....
No. 1 Canadian, f.o.b. mill, powd. long ton		20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl. lb.		.05½ –	.06
Ceylon, chip, bbl. lb.		.04½ –	.05
High grade amorphous crude ton		15.00 –	30.00
Gum arabic, amber, sorts, bags lb.		.13 –	.13½
Gum tragacanth, sorts, bags lb.		.50 –	.55
No. 1, bags lb.		1.35 –	1.40
Kieselguhr, f.o.b. Cal. ton		40.00 –	42.00
F.o.b. N. Y. ton		50.00 –	55.00
Magnesite, crude, f.o.b. Cal. ton		14.00 –	15.00
Pumice stone, imp., casks lb.		.03 –	.05½
Dom., lump, bbl. lb.		.05 –	.05½
Dom., ground, bbl. lb.		.05½ –	.06
Silica, glass sand, f.o.b. Ind. ton		2.00 –	2.50
Silica, sand blast, f.o.b. Ind. ton		2.25	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill. ton		20.00 –	.....
Silica, glass sand, f.o.b. Ill. ton		1.75 –	3.00
Soapstone, coarse, f.o.b. Vt., bags ton		7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra ton		8.00 –	8.50
Talc, 200 mesh, f.o.b. Ga., bags ton		8.00 –	9.00
Talc, 350 mesh, f.o.b. New York, grade A bags ton		22.00 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.00 –	$3.25
Corning	bbl.	1.50 –	.....
Cabell	bbl.	1.45 –	.....
Somerset	bbl.	1.40 –	.....
Illinois	bbl.	1.42 –	.....
Indiana	bbl.	1.43 –	.....
Kansas and Okla. under 28deg.	bbl.	.50 –	.....
California, 35 deg. and up	bbl.	.74 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.15½ –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal	.14½ –	.....
Kerosene, ref. tank wagon	gal.	.15 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.09½ –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.25 –	.....
Bloomless, 30@31 grav.	gal.	.17½ –	.....
Paraffin, pale	gal.	.16½ –	.17
Spindle, 200, pale	gal.	.21 –	.21½
Petrolatum, amber, bbls.	lb.	.03½ –	.04
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50–53
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50–53
F.o.b. Mt. Union, Pa.	1,000	42–45
Silicon carbide refract. brick, 9-in.	1,000	1150.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	$225.00

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 –	
4-6% C	lb.	.12 –	
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	109.00 –	
Spiegeleisen, 19-21% Mn	gr. ton	40.00 –	
Ferromolybdenum, 50-60% Mo, per lb Mo	lb.	2.00 –	2.50
Ferrosilicon, 10-12%	gr. ton	43.00 –	50.00
50%	gr. ton	82.50 –	85.00
Ferrotungsten, 70-80%, per lb. of W	lb.	.88 –	.95
Ferro-uranium, 35-50% o U. per lb. of U	lb.	4.50 –	
Ferrovanadium, 30-40% per lb. of V	lb.	3.50 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	19.50 –	21.50
Coke, fdry., f.o.b. ovens	ton	5.00 –	5.50
Coke, furnace, f.o.b. ovens	ton	3.75 –	4.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 –	
Ilmenite, 52% TiO_2	lb.	.00½–	.01
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.38 –	.42
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb	.06 –	.08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	
Rutile, 95% TiO_2	lb.	.10 –	
Tungsten, scheelite, 60% WO_3 and over	unit	9.50 –	10.00
Tungsten, wolframite, 60% WO_3	unit	8.50 –	9.00
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1 00 –	1.25
Zircon	ton	50.00 –	

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12½-	$0.12¼
Aluminum, 98 to 99%	lb.	.26 –	.27
Antimony, wholesale, Chinese and Japanese	lb.	.09½–	.10¼
Nickel, 99%	lb.	.27 –	.30
Monel metal, shot and blocks	lb.	.32	
Monel metal, ingots	lb.	.38	
Monel metal, sheet bars	lb.	.45	
Tin, 5-ton lots, Straits	lb.	.47¼	
Lead, New York, spot	lb.	7.75	
Lead, E. St. Louis, spot	lb.	7.75	
Zinc, spot, New York	lb.	.0662½	
Zinc, spot, E. St. Louis	lb.	.0627½	
Silver (commercial)	oz.	.64¼	
Cadmium	lb.	.75@	.80
Bismuth (500 lb. lots)	lb.	2.55	
Cobalt	lb.	3.00-3 25	
Magnesium, ingots, 99%	lb.	.90-.95	
Platinum	oz.	125.00	
Iridium	oz.	275.00-300.00	
Palladium	oz.	83.00	
Mercury	75 lb.	60.00	
Tungsten	lb	.95-1.00	

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.50
Copper bottoms	29.75
Copper rods	19 75
High brass wire	18.00
High brass rods	15 75
Low brass wire	20.25
Low brass rods	20.50
Brazed brass tubing	23.50
Brazed bronze tubing	27.00
Seamless copper tubing	25.50
Seamless high brass tubing	24.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	9.00@	9.50
Copper, heavy and wire	10.25@	10.50
Copper, light and bottoms	8.50@	8.75
Lead, heavy	5.50@	5.62½
Lead, tea	3.50@	3 75
Brass, heavy	6.00@	6.25
Brass, light	5.25@	5.50
No. 1 yellow brass turnings	5.75@	6.00
Zinc scrap	3.75@	4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.35
Plates, ¼ to 1 in. thick	3.64	3.64

Technical Societies, Trade Associations and Commercial Organizations

Amer. Assn. for the Advancement of Science. Sec., Dr. Burton E. Livingston. Smithsonion Inst. Bldg., Washington, D. C.

Amer. Assn. of Cereal Chemists. Sec., R. K. Durham, 440 N. Y. Life Bldg., Kansas City, Mo.

Amer. Assn. of Engrs. Sec., C. D. Drayer, 63 East Adams St., Chicago, Ill.

Amer. Assn. of Flint and Lime Glass Mfrs. Sec., John Kunzler, House Bldg., Pittsburgh, Pa.

Amer. Assn. of Ice & Refrigeration Engrs. Sec. L. C. Smith, 163 W. Washington St., Chicago, Ill.

Amer. Assn. of Operating Engrs. Sec., H. C. Bristol, Calderwood, Tenn.

Amer. Assn. of Refrigeration, Sec., J. F. Nickerson, 421 S. Dearborn St., Chicago, Ill.

Amer. Assn. of Textile Chemists & Colorists. Sec., Walter E. Hadley, 5 Mountain Ave., Maplewood, N. J.

Amer. Bakers Assn. Sec., Dr. H. E. Barnard, 1135 Fullerton Ave., Chicago, Ill.

Here is a compilation of technical and commercial organizations in the chemical engineering and related fields that should prove valuable as a reference directory. An effort has been made in each case to give the name and address of the secretary or other responsible official. *Chem. & Met.* welcomes additions or corrections in order that when the revised list is published at the beginning of our next volume, it will be of maximum usefulness to our readers.

Address the Editor, *Chemical & Metallurgical Engineering*, 10th Ave. at 36th St., New York City.

Amer. Ceramic Society. Sec., Ross C. Purdy, Lord Hall, Ohio State Univ., Columbus, Ohio.

American Chemical Society. Sec., Dr. Charles L. Parsons, 1709 G St., N.W., Washington, D. C.

Amer. Concrete Institute. Sec., Harvey Whipple, 1807 E. Grand Blvd., Detroit, Mich

Amer. Concrete Pipe Assn. Sec., M. W. Loving, 111 W. Washington St., Chicago, Ill.

Amer. Electrochemical Soc. Sec., Dr. C. G. Fink, Columbia Univ., New York.

Amer. Electro-Platers' Soc. Sec., Frank J. Hanlon, 216 N. Jefferson St., Chicago, Ill.

Amer. Engineering Standards Committee. Sec., P. G. Agnew, 29 W. 39th St., New York.

Amer. Face Brick Assn. Sec., R. D T. Hollowell, 130 N. Wells St., Chicago, Ill.

Amer. Foundrymen's Assn. Sec., C. E. Hoyt, 1012 Marquette Bldg., Chicago, Ill.

Amer. Gas Assn. Sec.-Mgr., Oscar Fogg, 342 Madison Ave., New York.

Amer. Gear Manufacturers Assn. Sec., T. W. Owen, Room 107, 2443 Prospect Ave., Cliveland, Ohio.

Amer. Inst. of Baking. Director, Dr. H. E. Barnard, 1135 Fullerton Ave., Chicago, Ill.

Amer. Inst. of Chemical Engrs. Sec., Dr. J. C. Olsen, Polytechnic Inst., Brooklyn, N. Y.

Amer. Inst. of Chemists. Pres., Prof. H. G. Byers, Cooper Union, New York.

Amer. Inst. of Consulting Engrs. Sec., Col. F. A. Molitor, 143 Liberty St., New York.

Amer. Inst. of Electrical Engrs. Sec., F. L. Hutchinson, 33 W. 39th St., New York.

Amer. Inst. of Fertilizer Chemists. Sec.-Treas., W. J. Gascoyne, Jr., 27 S. Gay St., Baltimore, Md.

Amer. Inst. of Mining & Metallurgical Engrs. Sec., Frederick F. Sharpless, 29 W. 39th St., New York.

Amer. Iron & Steel Institute. Sec., E. A. S. Clarke, 40 Rector St., New York.

Amer. Leather Chemists Assn. Sec. H. C. Reed, 22 E. 16th St., New York.

Amer. Malleable Castings Assn. Sec.-Treas., Robert E. Belt, 1900 Euclid Bldg., Cleveland, Ohio.

American Manufacturers of Toilet Articles. Sec., C. M. Baker, c/o Ponds Extract Co., 131 Hudson St., New York.

Amer. Manufacturers' Export Assn. Sec., Maurice B. Bean, 160 Broadway, New York.

Amer. Mining Congress. Sec., J. F. Callbreath, 841 Munsey Bldg., Washington, D. C.

American Museum of Safety. Director, Albert A. Hopkins, 141 E. 29th St., New York.

Amer. Oil Chemists' Society. Sec., Thomas B. Caldwell, Wilmington, N. C.

Amer. Paper & Pulp Assn. Exec. Sec., Hugh P. Baker, 18 East 41st St., New York.

Amer. Peat Soc. Sec.-Treas., Charles Knap, 2 Rector St., New York.

Amer. Petroleum Inst. Sec., R. L. Welch, 15 W. 44th St., New York.

Amer. Physical Soc. Sec., D. C. Miller, Case School of Applied Science, Cleveland, Ohio.

Amer. Pig Iron Assn. Sec., John A. Penton, Penton Bldg., Cleveland, Ohio.

Amer. Society of Agricultural Engrs. Sec., Raymond Olney, Mt. Clemens, Mich.

Amer. Society of Civil Engrs. Sec., John H. Dunlap, 29 W. 39th St., New York.

Amer. Soc. for Heating & Ventilating Engrs. Sec., Casin W. Obert, 29 W. 39th St., New York.

Amer. Soc. of Mechanical Engrs. Sec. Calvin W. Rice, 29 W. 39th St., New York.

Amer. Soc. of Refrigerating Engrs. Sec., William H. Ross, 35 Warren St., New York.

Amer. Soc. of Safety Engrs. Sec., Gene S. Wood, 29 W. 39th St., New York.

Amer. Soc. for Steel Treating. Sec., W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

Amer. Soc. for Testing Materials. Sec.-Treas., C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Amer. Welding Soc. Sec., Miss M. M. Kelly, 33 W. 39th St., New York.

Amer. Wood-Preservers' Assn. Sec., P. P. Hicks, 1146 Otis Bldg., Chicago, Ill.

Amer. Zinc Inst., Inc. Sec., Stephen S. Tuthill, 27 Cedar St., New York.

Associated Cooperage Industries of Amer. Sec., C. G. Hirt, B-20 Railway Exchange Bldg., St. Louis, Mo.

Associated Corn Products Manufacturers. Sec., Dr. W. P. Cutler, 208 So. La Salle St., Chicago, Ill.

Associated Tile Mfrs. Sec., F. W. Walker, Beaver Falls, Pa.

Assn. of Amer. Steel Manufacturers. Sec., J. O. Leech, c/o Carnegie Steel Co., Pittsburgh, Pa.

Assn. of British Chemical Mfrs., Gen.-Mgr. & Sec., W. J. U. Woolcock, 166, Piccadilly, London, W. 1, England.

Assn. of Iron and Steel Electrical Engrs. Sec., John F. Kelly, 708 Empire Bldg., Pittsburgh, Pa.

Assn. of Official Agricultural Chemists. Sec., W. W. Skinner, Box 290 Pennsylvania Ave. Station, Washington, D. C.

Assn. of Scientific Apparatus Makers of the U. S. A. Sec., J. M. Roberts, 460 E. Ohio St., Chicago, Ill.

Assn. of Wood Using Industries. Sec., William B. Baker, 531 Monadnock Bldg., Chicago, Ill.

Biscuit & Cracker Mfrs. Assn. Sec., R. T. Stokes, 90 West Broadway, New York.

British Assn. for the Advancement of Science. Sec., O. J. R. Howarth, Burlington House, Piccadilly, London, W. 1, England.

British Cast Iron Research Assn. Sec., Thomas Vickers, Central House, New St., Birmingham, England.

British Non-Ferrous Metal Research Assn. Sec., Dr. R. S. Hutton, Athenaeum Chambers, 71, Temple Row, Birmingham, England.

Canadian Engineering Standards Assn. Sec., R. J. Durley, 638-9 Jackson Bldg., Ottawa, Ont., Canada.

Canadian Inst. of Chemistry. Sec., L. E. Westman, 57 Queen St., W., Toronto, Ont., Canada.

Canadian Inst of Mining & Metallurgy. Sec., G. C. Mackenzie, 603 Drummond Bldg., 511 St. Catherine St., W., Montreal, Canada.

Canadian National Clay Products Assn. Sec., Gordon C. Keith, 435 Grace St., Toronto, Ont., Canada.

Canadian Pulp & Paper Assn. Sec., Edward Beck, Room 701, Drummond Bldg., 511 St. Catherine St., W., Montreal, Que., Canada.

Canadian Society of Forest Engrs. Sec., Roland D. Craig, Journal Bldg., Ottawa, Canada.

Ceramic Society. Sec., Dr. J. W. Mellor, Central Science School, Stoke-on-Trent, England.

Cercle de la Chimie. Pres., P. Blondel, 54 Rue de Turbigo, Paris, France.

Chemical Equipment Assn. Sec., Roberts Everett, 1328 Broadway, New York.

Chemical, Metallurgical & Mining Society of South Africa, Inc. Sec., H. A. G. Jeffreys, Scientific & Technical Club, 100 Fox St., Johannesburg, Transvaal, South Africa.

Chemists' Club. Sec., H. G. Sidebottom, 52 E. 41st St., New York.

Circle of Scientific, Technical & Trade Journalists. Hon. Sec., Leon Gaster, 32 Victoria St., Westminster, London, S. W. 1, England.

Clay Products Assn. Sec., George C. D. Lenth, Chamber of Commerce Bldg., Chicago, Ill.

Common Brick Mfrs. Assn. of Amer. Sec., Ralph P. Stoddard, 2121 Cleveland Discount Bldg., Cleveland, Ohio.

Compressed Air Society. Sec., C. H. Rohrbach, 50 Church St., New York.

Compressed Gas Mfrs. Assn. Sec., John H. Hayes, 120 W. 42nd St., New York.

Copper & Brass Research Assn. Sec., George A. Sloan, 25 Broadway, New York.

Deutsche Chem Ges. Sec., Dr. H. Jost, Sigismundstr, 4, W. 10, Berlin, Germany.

Deutsche Zuckerindustrie, Dessauer Str., 18, Berlin, S.W. 11, Germany.

Drop Forge Supply Assn. Pres., Hollinshead N. Taylor, 300 Chestnut St., Philadelphia, Pa.

Eastern Clay Products Assn. Sec., H. T. Shelley, 906 Colonial Trust Bldg., Philadelphia, Pa.

Eastern States Blast Furnace and Coke Oven Assn. Sec., Dan M. Rugg, Buffalo, N. Y.

Engineering Foundation. Director, Alfred D. Flinn, 29 W. 39th St., New York.

Engineering Inst. of Canada. Sec., Fraser S. Keith, 176 Mansfield St., Montreal, Que., Canada.

Faraday Society. 10 Essex St., Strand, London, W.C. 2, England.

Federated Amer. Engineering Societies. Sec., L. W. Wallace, 26 Jackson Pl., Washington, D. C.

Franklin Inst. of the State of Pa. Sec., Dr. R. B. Owens, 15 S. 7th St., Philadelphia, Pa.

Glass Container Assn. Sec., R. E. Walker, c/o Turner Bros. Co., Terre Haute, Ind.

Hawaiian Sugar Planters' Assn., P. O. Box 411, Honolulu, Hawaii.

Illuminating Engineering Society. Gen. Sec., Norman D. MacDonald, Electrical Testing Co., 80th St. and East End Ave., New York.

Insecticide & Disinfectant Mfrs. Assn., Inc. Acting Sec., H. W. Cole, Holbrook, Mass.

Institute of Makers of Explosives. Sec., C. Stewart Comeaux, 103 Park Ave., New York.

Institute of Amer. Meat Packers. Pres., C. E. Herrick, 509 S. Wabash Ave., Chicago, Ill.

Institute of Margarin Manufacturers. Sec., Dr. J. S. Abbott, 1049 Munsey Bldg., Washington, D. C.

Institute of Metals. Sec., G. Shaw Scott, 36 Victoria St., Westminster, London, S. W. 1, England.

Institute of Mining Engineers. Sec., Charles McDermid, Cleveland House, 225 City Road, London, E.C. 1, England.

Institute of Radio Engineers. Sec., Dr. Alfred N. Goldsmith, College of the City of New York.

Institution of Engineers & Shipbuilders in Scotland. Sec., Edward H. Parker, Elmbank Crescent, Glasgow, Scotland.

Institution of Mining & Metallurgy. Sec., Charles McDermid, Cleveland House, 225 City Road, London, E.C. 1, England.

Institution of Petroleum Technologists. Sec., Commander R. E. Stokes-Rees, Aldine House, Bedford St., Strand, London, W. 2, England.

Instituto Cientifico e Industrial del Salitre. Gen. Sec., Belisario Diaz Ossa, Casilla 2730, Santiago, Chile.

International Acetylene Assn. Sec.-Treas., A. Cressy Morrison, 30 E. 42nd St., New York.

Interstate Cotton Seed Crushers' Assn., Inc. Sec., Robert Gibson, 201 N. Texas Bldg., Dallas, Tex.

Inventors' League of the U. S. 114 Maiden Lane, New York.

Iron & Steel Institute. Sec., G. C. Lloyd, 28 Victoria St., London, S.W. 1, England.

Magnesia Assn. of America. 246 N. 17th St., Philadelphia, Pa.

Manufacturing Chemists Assoc. of the U. S. Sec., J. I. Tierney, 540 Woodward Bldg., Washington, D. C.

Metric Assn. Sec., Howard Richards, 156 - 5th Ave., New York.

Mining & Metallurgical Soc. of Amer. Sec., Donald M. Liddell, 2 Rector St., New York.

Mirror Mfrs. Assn. Sec., H. C. Sorden, Shelbyville, Ind.

National Academy of Sciences. Sec., David White, Geological Survey, Washington, D. C.

National Assn. of Cost Accountants. Sec., Stuart C. McLeod, 130 W. 42nd St., New York.

National Assn. of Cotton Mfrs. Sec., Harry C. Meserve, 45 Milk St., Boston, Mass.

National Assn. of Glue & Gelatin Mfrs. Sec., H. B. Sweatt, 81 Fulton St., New York.

National Assn. of Leather Belting Mfrs. Sec., George H. Blake, P. O. Box 859, City Hall Sta., New York.

National Assn. of Mfrs. of Pressed & Blown Glassware. Sec., John Kunzler, House Bldg., Pittsburgh, Pa.

National Assn. of Mfrs. of the U. S. of Amer. Sec., George S. Boudinot, 50 Church St., New York.

National Assn. of Practical Refrigerating Engrs. Sec., E. H. Fox, 5707 West Lake St., Chicago, Ill.

National Assn. of Purchasing Agents. Sec., W. L. Chandler, 19 Park Place, New York.

National Assn. of Window Glass Mfrs. Sec., J. R. Johnston, Jr., 1701 First National Bank Bldg., Pittsburgh, Pa.

Natl. Bottle Mfrs. Assn. Sec., W. B. Swindell c/o Swindell Bros., Baltimore, Md.

National Brick Manufacturers' Assn. Sec., Theodore A. Randall, 211 Hudson St., Indianapolis, Ind.

National Canners' Assn. Sec., Frank E. Gorrell, 1739 H Street, N.W., Washington, D. C.

National Coal Assn. Exec. Sec., H. L. Gandy, 801 Southern Bldg., Washington, D. C.

National Conference of Business Paper Editors. Sec., Alfred G. Oehler, c/o *Railway Electrical Engineer*, 30 Church St., New York.

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National Fertilizer Assn. Sec., John D. Toll, c/o *American Fertilizer*, 1010 Arch St., Philadelphia, Pa.

National Fire Protection Assn. Sec., Franklin H. Wentworth, 40 Central St., Boston, Mass.

National Foreign Trade Council. Sec., O. K. Davis, 1 Hanover Sq., New York.

National Gas Products Assn. Ass't Sec., A. T. Kitchel, 41 E. 42nd St., New York.

National Industrial Conference Board. Comptroller, James M. Robertson, 10 E. 39th St., New York.

National Industrial Council. Sec. and Treas. Earl Constantine, 50 Church St., New York.

National Institute of Inventors. Sec., R. Nerenstone, 8 E. 14th St., New York.

National Lime Assn., Sec.-Gen. Mgr., William R. Phillips, 918 G St., N.W., Washington, D. C.

National Lumber Manufacturers Assn. of Chicago. Sec., Wilson Compton, Transportation Bldg., Washington, D. C.

National Metal Trades Assn. L. W. Fischer, 1019 Peoples Gas Bldg., Chicago, Ill.

National Ornamental Glass Mfrs. Assn. of U. S. & Canada. Sec., A. J. Schuler, 625 Jackson Blvd., Chicago, Ill.

National Paint, Oil & Varnish Assn. Sec., G. V. Horgan, 18 East 41st St., New York.

National Paving Brick Mfrs. Assn. Sec., Edward E. Duff, Jr., Engineers Bldg., Cleveland, Ohio.

National Petroleum Assn. C. D. Chamberlin, 823 Guardian Bldg., Cleveland, Ohio.

National Petroleum Marketers Assn. Pres., L. V. Nicholas, 76 W. Monroe St., Chicago, Ill.

National Pipe & Supplies Assn. Sec., Geo. D. McIlvaine, 908 Oliver Bldg., Pittsburgh, Pa.

National Research Council. Sec., Dr. Vernon Kellogg, 1701 Massachusetts Ave., Washington, D. C.

National Safety Council. Sec., W. H. Cameron, 168 N. Michigan Ave., Chicago, Ill.

National Wood Chemical Assn. Sec.-Treas., F. J. Goodfellow, 76 Main St., Bradford, Pa.

New Jersey Chemical Society. Sec., Frederick W. Zons, 367 High St., Newark, N. J.

New Jersey Clay Workers Assn. & Eastern Section of the American Ceramic Society. Sec., G. H. Brown, Ceramics Dept., Rutgers College, New Brunswick, N. J.

New York Acadamy of Sciences. Sec., Dr. Ralph W. Tower, 77th St. and Central Park West, New York City.

Oil & Colour Chemists' Assn. Sec., H. A. Carwood, 53 Groombridge Rd., London, E. 9, England.

Plate Glass Mfrs. of Amer. Sec., P. A. Hughes, First National Bank Bldg., Pittsburgh, Pa.

Portland Cement Assn. Sec.-Gen. Mgr., William M. Kinney, 111 W. Washington St., Chicago, Ill.

Refractories Manufacturers Assn. Sec., Frederic W. Donahoe, 840 Oliver Bldg., Pittsburgh, Pa.

Rubber Assn. of America. Gen. Mgr. and Sec., 250 West 57th St., New York.

Rubber Growers' Assn., Inc. 2, 3 and 4 Idol Lane, Eastcheap, London, E.C. 3, England.

Salesmen's Assn. of the American Chemical Industry. Sec., A. J. Binder, c/o Sherwin-Williams Co., 115 Broadway, New York.

Sand-Lime Brick Assn. Sec., J. S. Palmer, Rebewaing, Mich.

Société de Chimie Industrielle. Sec., Jean Gerard, 49 Rue des Mathurins, Paris, France.

Société d'encouragement pour l'Industrie Nationale. 44 rue de Rennes, Paris, France.

Society of Chemical Industry. Sec., J. P. Longstaff, 46 Finsbury Sq., London, E.C. 2, England.

Society of Chemical Industry (N. Y. Section). Sec., Allen Rogers, Pratt Institute, Brooklyn, N. Y.

Society of Dyers & Colourists. Sec., J. B. Atkinson, Pearl Assurance Bldgs., Market St., Bradford, England.

Society of Glass Technology. Sec., S. English, Darnall Road Sheffield, England.

Society of Industrial Engrs. Exec. Sec., George C. Dent, 608 S. Dearborn St., Chicago, Ill.

Society of Leather Trades Chemists. Sec., W. R. Atkin, University, Leeds, England.

Society for the Promotion of Engineering Education. Sec., Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South African Chemical Institute. Sec., James Gray, Box 5254, Johannesburg, So. Africa.

South African Institution of Engrs., Inc. Sec., W. W. R. Jago, Box 4609, Johannesburg, So. Africa.

Steel Barrel Mfrs. Assn. Sec., D. S. Hunter, 428 Bulkley Bldg., Cleveland, Ohio.

Synthetic Organic Chem. Mfrs. Assn. of the U. S. Exec. Officer, Dr. Chas. H. Herty, Pres., Room 343, 1 Madison Ave., New York.

Talc & Soapstone Producers Assn. Sec.-Treas., Raymond B. Ladoo, Box 557, Cleveland, Tenn.

Tanners' Council. Sec., E. A. Brand, 41 Park Row, New York.

Taylor Society. Managing Director, Harlow S. Person, 29 W. 39th St., New York.

Technical Assn. of the Pulp & Paper Industry. Sec., W. G. MacNaughton, 18 E. 41st St., New York.

Technical Photographic & Microscopical Soc. Sec.-Treas., Alfred B. Hitchins, c/o Ansco Co., Binghamton, N. Y.

Technical Publicity Assn. Sec., C. L. Packard, Western Electric Co., Room 1414, 100 E. 42nd St., New York.

Textile Alliance. Pres., A. M. Patterson, 45 E. 17th St., New York.

Union Internationale de la Chimie Pure et Applique. Sec., Jean Girard, 49 Rue des Mathurins, Paris, France.

United Engineering Society. Sec., Alfred D. Flinn, 29 W. 39th St., New York.

U. S. Potash Producers' Assn. Exec. Sec., Frederick W. Brown, 604 Southern Bldg., Washington, D. C.

U. S. Potters Assn. Sec., Charles F Goodwin, East Liverpool, Ohio.

Washington Academy of Science. Sec., F. B. Silsbee, Bureau of Standards, Washington, D. C.

Western Petroleum Refiners Assn. Sec., John Reynolds, 304 Inter-State Bldg., Kansas City, Mo.

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

California

SAN JACINTO—The Riverside Cement & Roofing Co. has plans nearing completion and will soon break ground for the construction of a new plant on the Relief Hot Springs Road for the manufacture of cement tile roofing products. It will be equipped to give employment to about 200 operatives and is estimated to cost in excess of $65,000.

LOS ANGELES—The Union Oil Co., Union Oil Bldg., is planning for the construction of four new refining units at its plant on the Harbor Blvd. during 1924, with other extensions to include an asphalt refinery, loading docks and auxiliary structures. The expansion is estimated to cost approximately $500,000.

SAN DIEGO—The California Clay Products Co., affiliated with the Vitrified Clay Products Corp., Victor Kremer, president, San Diego, is arranging a fund of about $200,000 for a new plant for the manufacture of tile and kindred burned clay products at Cardiff-by-the-Sea, where the company has extensive raw material deposits. Work will begin at an early date.

Delaware

WILMINGTON—The Wilmington Sugar Refining Co. is preparing to resume the construction of its proposed refinery on C St., South Wilmington, early in January, following a retention of operations for some time past. It is purposed to have the plant equipped and ready for service in about 6 months. The rated capacity will approximate 5,000 bbl. per day, with employment of close to 800 operatives. It will represent an investment in excess of $650,000. Adolph Segal, Philadelphia, Pa., heads the company.

Florida

MIAMI — The Pennsylvania Sugar Co., Delaware Ave., Philadelphia, Pa., is completing the initial units of its new refining plant in the Everglades, near Miami, and plans to place the mill in service during January. It will represent an investment of more than $1,200,000. The company is planning for the establishment of an auxiliary mill for the manufacture of paper products, utilizing the cane waste and pulp as raw material.

Illinois

GRANITE CITY—The Linde Air Products Co., 30 East 42nd St., New York, manufacturer of industrial oxygen, etc., has preliminary plans in preparation for the construction of a new plant at Madison and 16th Sts., Granite City, and purposes to call for bids on a general contract in the near future.

Indiana

GREENFIELD—The Ball Brothers Co., Muncie, Ind., manufacturer of fruit jars, tumblers and other glass products, has acquired the local No. 5 plant of the Owens Bottle Co., Toledo, O. A portion of the works will be used for expansion and considerable machinery will be removed to the Muncie plant for extensions in different departments.

Kentucky

OWENSBORO—The Owensboro Clay Products Co. is pushing construction of its new local plant and plans to have ready for operations in a few months. The works will consist of four kilns, each with eight furnaces, and a number of plant units, to be devoted to the manufacture of tile and kindred products, initial capacity totaling about 20,000 pieces per day, to be increased later. The plant will cost approximately $150,000, with machinery.

Louisiana

LOREAUVILLE—The Loreauville Sugar Co. has authorized plans for the rebuilding of its local sugar-refining plant, known as the Vida refinery, recently destroyed by fire, caused by an explosion. Considerable additional machinery will be installed. The new mill will be designed to develop an output of 650 tons per day.

Maine

RUMFORD — The Oxford Paper Co. has work in progress on the installation of additional equipment at its plant for extensive increase in capacity in the line of fine coated papers. It is expected to have the enlarged mill ready for service in February, when a production basis of 340 tons per day will be established.

Maryland

BALTIMORE—The Maryland Steel Rolling Co. is said to be perfecting plans for the construction of a new mill on local site, supplementing its present plant at Trenton, N. J., to be used for the manufacture of strip steel products. The new plant will cost in excess of $100,000, with equipment.

BALTIMORE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron products, etc., has filed plans for the construction of three new buildings at its proposed plant on 5th Ave., Canton section, consisting of one 3-story and two 2-story units, 100x250 ft., 171x350 ft. and 105x130 ft., respectively, estimated to cost $700,000, with machinery. Foundations will be laid at once.

Missouri

KANSAS CITY—The Western Terra Cotta Co., 1st and Franklin Sts., has completed plans and will commence the construction of a 1-story addition, 65x78 ft., at Franklin and Water Sts., estimated to cost $20,000.

New Jersey

MATAWAN—The Chemical & Metallurgical Co., Matawan, recently formed, has acquired the former local plant of the American Tin Smelteries, consisting of a tract of about 16 acres of land and a number of buildings, averaging 46x125 ft., with laboratory. The new owner will take immediate possession, and plans to remodel and equip the works for the production of chemical and metallurgical products.

NEWARK—The Briggs Bituminous Composition Co., 17 Battery Pl., New York, is having plans drawn for the erection of a new 1-story plant at Wilson and Ball Sts., estimated to cost about $37,000. Walter Kidde & Co., 90 West St., New York, are engineers.

New York

NEW YORK—Levering Brothers, William St. and Key Highway, Baltimore, Md., manufacturers of iron castings, have acquired the plant of the Acme Foundry Co., East 59th St., New York, and will remodel and improve for a new branch foundry. The plant has been giving employment to more than 400 operatives and will be maintained on this basis. The Levering company will continue the operation of its present branch plants at Buffalo, N. Y., and Hanover and York, Pa.

North Dakota

GRAND FORKS—The Minnesota Sugar Co., Chaska, Minn., has plans under way for the construction of a large refining plant on site selected at Grand Forks, to consist of a number of units, with power house, machine shop and other structures, estimated to cost in excess of $750,000, with machinery. It is purposed to have the mill ready for service for the 1925 season.

Ohio

CAMBRIDGE—The American Sheet & Tinplate Co. has preliminary plans under way for the construction of a number of new buildings at its local Guernsey steel works, estimated to cost close to $350,000, including equipment. One of the structures will be equipped as an extension to the present annealing department.

MASSILLON—Officials of the Rhodes Glass & Bottle Co. are perfecting plans for the organization of a new company, to be known as the Stark Glass Co. It will specialize in the production of wide-mouth bottles, and will probably use a portion of the present works of the parent company for initial production, to be expanded later.

CANTON—The plant and business of the Old King Cole Papier Mache Co. has been acquired by new interests headed by R. E. MacKenzie. Plans are under way for a reorganization of the company under the name of Old King Cole, Inc., and extensions and improvements in the present works. Mr. MacKenzie will head the new company.

YOUNGSTOWN—The Republic Iron & Steel Co. has authorized plans for the construction of a new open-hearth steel furnace at its local mills, to cost in excess of $750,000, with equipment.

Pennsylvania

DARLINGTON—The Darlington Clay Products Co., manufacturer of tile, etc., has tentative plans under advisement for the rebuilding of the portion of its local plant, destroyed by fire, Dec. 27, with loss estimated at $150,000, including equipment. George Seanor is superintendent.

PITTSBURGH—S. Strunz & Son, 708 Bingham St., manufacturers of soap, have acquired property adjoining their plant, 95x100 ft., for a consideration of $31,000, and plan to use the site for extensions.

ERIE—George C. Gensheimer, secretary to the commissioner of public works, will take bids until Jan. 23 for the construction of an addition to the municipal filter plant at the waterworks, to provide for an increase of 8,000,000 gal. in capacity, with complete machinery and auxiliary equipment, as per plans at the office of J. N. Chester, Union Bank Bldg., Pittsburgh, Pa., engineer.

GETTYSBURG—The plant and business of the Keystone Chemical Co. have been acquired by new interests, headed by Ralph W. Baker. The new owner plans to organize a company to operate the property, and will make extensions and improvements.

Tennessee

NASHVILLE—The Tennessee Enamel Co. has tentative plans under consideration for the rebuilding of the portion of its plant on 40th St., recently destroyed by fire with loss estimated at close to $50,000, including equipment.

Texas

BRECKENRIDGE—The Souders & Fisher Co. will commence the construction of a new oil-refining plant on the B. S. Walker property, about 7 miles from the city, for the production of gasoline. It is estimated to cost approximately $200,000, including equipment.

DALLAS—The American Sulphur & Fertilizer Co., Pecos, Tex., has purchased a trat of property in the Love Field industrial district, Dallas, for the establishment of a new plant. The initial works will be equipped primarily for the crushing and sorting of ores in dry state, and later will be extended to include other branches of production. Existing buildings will be remodeled and improved. J. A. Price is president.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS. Bristol, England. Agency.—8729.

CHEMICALS. Lima, Peru. Agency.—8761.

PAINTS AND VARNISHES. Bombay, India. Agency.—8693.

PYROXYLIN PLASTIC (cellulose acetate base). Vienna, Austria. Purchase.—8749.

VARNISHES for metals and wood. Prague. Czechoslovakia. Purchase.—8763.

FATS, EDIBLE. Cologne, Germany. Purchase.—8720.

TAR AND BITUMEN for roads. Glasgow. Scotland. Purchase.—8766.

GASOLINE, kerosene, lubricating oil, and other oil products. Nuremberg, Germany. Purchase.—8762.

SOAPS, TOILET. Bristol, England. Agency.—8729.

SOAPS, TOILET. Buitenzorg, Java. Exclusive agency.—8759.